QE6
1899
v.1
MOLL

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

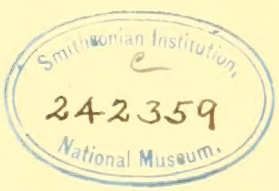
ENGLAND.

BY

HENRY WOODS, M.A.,

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

VOL. I.



LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1899—1903.

PRINTED BY ADLARD AND SON, LONDON AND DORKING.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

LONDON:

MDCCCXCIX—MDCCCCIII.

MONOGRAPH OF THE CRETACEOUS LAMELLIBRANCHIA OF ENGLAND.

VOL. I.

ORDER OF BINDING AND DATES OF PUBLICATION.

PAGES	PLATES	ISSUED IN VOL. FOR YEAR	PUBLISHED
General Title-page, Contents, Introduction, and Bibliography, i—xliii	—	1903	December, 1903
1—72	I—XIV	1899	December, 1899
73—112	XV—XIX	1900	December, 1900
113—144	XX—XXVI	1901	December, 1901
145—196	XXVII—XXXVIII	1902	December, 1902
197—232	XXXIX—XLII	1903	December, 1903

CONTENTS.

	PAGE
Introduction	vii
Bibliography	xi
Description of species	1
Nuculana	1
Nucula	12
Anomia	27
Arca	32
Barbatia	35
Grammatodon	44
Trigonoarca	47
Cucullæa	49
Isoarca	65
Pectunculus	66
Limopsis	71
Trigonia	73
Mytilus	91
Modiola	92
Crenella	104
Lithodomus	105
Septifer	106
Dreissensia	110
Myoconcha	111
Spondylus	116
Plicatula	134
Pecten (Syncyclonema)	145
„ (Camptonectes)	152
„ (Chlamys)	163
„ (Equipecten)	186
„ (Neithea)	197
Velopecten	218
Hinnites	220
Additions and corrections	224
Index	227

INTRODUCTION.

Detailed accounts of three families only of English Cretaceous Lamellibranchs have hitherto been given, namely, the Trigoniidæ by Lycett, and the Nuculidæ and Nuculanidæ by Gardner. Numerous species, however, belonging to various families, were described and figured by J. and J. de C. Sowerby in the 'Mineral Conchology,' and a few also by Parkinson in his 'Organic Remains of a Former World.' A number of works, dealing primarily with the stratigraphy of the Cretaceous beds, also contain descriptions and illustrations of Cretaceous Lamellibranchs from certain districts or from special horizons. One of the earliest of these is 'The Fossils of the South Downs; or, Illustrations of the Geology of Sussex,' by Gideon Mantell (1822), in which a number of Lamellibranchs from the Gault and Chalk of the south-east of England are described and figured; but unfortunately the figures are not very satisfactory, and in many cases the type-specimens are now missing; nevertheless, with the aid of other examples collected from the same localities, it is usually possible to discover the characters of Mantell's species.

Another early work dealing with a special district is the 'Illustrations of the Geology of Yorkshire,' by John Phillips (1829), in which a few Lamellibranchs from the Speeton Clay are figured and others recorded. In 'An Outline of the Geology of Norfolk,' by S. Woodward (1833), the more important species from the Norwich Chalk are illustrated, but descriptions are not given.

In Fitton's great memoir (1836) on 'The Strata between the Chalk and the Oxford Oolite in the south-east of England,' many species of Lamellibranchs, chiefly from Blackdown, are excellently figured and briefly described by J. de C. Sowerby; and most of the type-specimens are now preserved in the Bristol Museum. An account of the more important Lamellibranchs from the Lower Greensand of the Isle of Wight and of the Weald is given by Edward Forbes (1845) in a paper entitled 'Catalogue of Lower Greensand Fossils in the Museum of the Geological Society,' Part I. Most of the specimens therein described may still be seen in the Society's Museum.

Dealing with almost the same area as Mantell's work is the later publication of

F. Dixon on 'The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex' (1850 or 1852). This contains excellent figures of some Chalk Lamellibranchs by J. de C. Sowerby, but the descriptions of the species are very brief, or in some cases even omitted; moreover, the type-specimens appear to have been lost, and in many instances their original locality is not stated.

The latest work on the Lower Cretaceous Lamellibranchs of England is that by W. Keeping on 'The Fossils and Palæontological Affinities of the Neocomian Deposits of Upware and Brickhill' (1883). Most of the original specimens described in that memoir are preserved in the Cambridge Museum.

A few papers have been published from time to time on the Lamellibranchs of special horizons, such as those of the Cambridge Greensand by Seeley (1861) and by Jukes-Browne (1875, 1877); those of the Faringdon Greensand by Sharpe (1853); those of the Chalk of Cambridge by Etheridge (1881); and those of the Chalk Rock by myself (1897). Various papers dealing with Cretaceous stratigraphy give brief notes on some of the species of Lamellibranchs.

The distribution of the Cretaceous Lamellibranchs of England is indicated in many books and papers on stratigraphical and local geology. The more important of those dealing with the Lower Cretaceous deposits are :—(i) on the Isle of Wight by Fitton (1847), and by Bristow, Reid, and Strahan (1889); (ii) on the Weald by Topley (1875); (iii) on Faringdon by Phillips (1871); (iv) on Lincolnshire by Keeping (1882) and others; (v) on Speeton by Lamplugh (1889, 1896).

The distribution of Lamellibranchs in the Gault is given in great detail by Price (1879); in the Upper Greensand of Blackdown and Haldon by Downes (1882), in that of Warminster by Jukes-Browne (1896), and in the Upper Greensand and Chloritic Marl of Maiden Bradley by Jukes-Browne and Scanes (1901). Amongst the more important works dealing with the zonal distribution in the Chalk are those by Barrois (1876), Meÿer (1874), Jukes-Browne and Hill (1886–96), Griffith (1891), and Rowe (1900, 1901, 1903).

The distribution of Cretaceous Lamellibranchs in different districts is also indicated in numerous memoirs issued by the Geological Survey other than those above referred to; and revised lists showing the general distribution of the species in the Upper Cretaceous rocks are given in the memoir on 'The Cretaceous Rocks of Britain,' by Jukes-Browne, vol. i, 1900, pp. 453—487, and vol. iii (in the press).

The following monograph deals with the Lamellibranchs of all the Cretaceous deposits of England, with the exception of the Wealden formation, which, it is thought, will be more satisfactorily studied in connection with Mollusca of the Purbeck Beds. The species found in the lowest part of the Speeton Series in Lincolnshire and Yorkshire are, as a matter of convenience, included in this work, although they may possibly prove to be of Upper Jurassic age. The families are here considered generally in the order given in Pelseneer's classification.

Some of the disadvantages of taking such a great range of formations are obvious. For example, it is almost impossible to collect personally from such an extensive series of beds, or to become sufficiently familiar with their stratigraphical details and foreign equivalents. The first of these objections is to a large extent removed by the magnificent collections which have been made by many enthusiastic and careful workers in the Cretaceous rocks. Some of these collections are still in private hands; many are now preserved in private museums; but all have been placed freely at my disposal.

Although works dealing with the fossils of limited horizons are often of great service to stratigraphical geologists and collectors, yet, from a palæontological standpoint, such works are apt to be somewhat unsatisfactory, since, owing to the want of sufficient material for comparison from other horizons, the importance of slight differences is liable to be overrated, and a proper idea of the variability of the species can scarcely be obtained. Further, some of the differences between forms from different beds and successive horizons are found to be due merely to dissimilar preservation, or are connected, just as is the case at the present day, with the varying conditions under which the forms lived. Moreover, the knowledge of a genus obtained from the study of a number of species from various horizons is obviously much more thorough than when only a few forms from one horizon are being considered.

From a biological standpoint the most satisfactory method would be to study a small group, such as a genus or family, and trace it through all formations from its earliest appearance to the present day or to the period of its extinction; and further, not to limit oneself, as is usually done, to a single country, but to study the representatives found in all parts of the world. The difficulties of obtaining specimens and of undertaking such extensive travel as that method of work would involve are very great; but quite as great, in the case of Lamellibranchs, is the difficulty of becoming familiar with the enormous literature which exists on this group of molluscs from every geological system. Consequently this method can scarcely be attempted until monographs on the Lamellibranchs found in all the geological systems of most countries have appeared. Moreover, such monographs are urgently needed in stratigraphical investigations. So that, great as is the labour involved in the preparation of a monograph on the Lamellibranchs of any geological system, it can scarcely be regarded as more than a necessary preliminary to the work which will be carried out in the future on many interesting problems in phylogeny and stratigraphy.

Amongst the collections which have been studied in the course of this work are those in the British Museum, the Museum of Practical Geology, and the Geological Society of London; the Museums of Bath, Bristol, Brighton, Cambridge, Exeter, Norwich, and York. In all cases help has been freely given by those

officially connected with the institutions named, and in this respect I desire to express my sincere thanks to Mr. H. A. Allen, Mr. H. Bolton, Mr. W. Rupert Jones, Mr. F. Leney, Mr. E. T. Newton, Mr. R. B. Newton, Mr. H. M. Platnauer, Mr. F. R. Rowley, and Dr. A. Smith Woodward. I am also greatly indebted to several geologists for the loan of specimens from their collections, especially to Dr. H. P. Blackmore, Mr. R. M. Brydone, Mr. G. E. Dibley, Mr. R. Fortin, Mr. C. Griffith, Mr. A. de Grossouvre, Professor E. Holzapfel, Mr. A. J. Jukes-Browne, Mr. G. W. Lamplugh, Mr. J. P. J. Ravn, Mr. C. Reid, Dr. A. W. Rowe, Mr. J. Scanes, Mr. J. W. Stather, Mr. J. F. Walker, and Dr. A. Wollemann. I must likewise thank Mr. Jukes-Browne and Dr. F. L. Kitchin for their kindness in reading the proofs and for other valuable assistance, whilst in bibliographical difficulties I owe much to the ever-ready help and unrivalled knowledge of Mr. C. Davies Sherborn.

A portion of the travelling expenses involved in the preparation of this work and a part of the cost of the drawings have been defrayed from two grants made to me by the Government Grant Committee of the Royal Society. Every facility for carrying on this work in the Woodwardian Museum has been given me by Professor T. McKenny Hughes, whose kindness I gladly take this opportunity of gratefully acknowledging.

BIBLIOGRAPHY OF THE CRETACEOUS LAMELLIBRANCHIA.

[This Bibliography does not include Stratigraphical Memoirs which give only lists of Cretaceous Lamellibranchs.]

Agassiz, L. Études critiques sur les Mollusques fossiles. Neuchatel, 1840–45. Part I, 1840; Part II, 1842; Part III, 1842; Part IV, 1845.

Alessandri, G. de. Fossili cretacei della Lombardia. *Palæont. Ital.*, vol. iv (1898), p. 169. [Lamellibranchs, pp. 180—189, 191—200.]

—— Nuovi Fossili de Senoniano Lombardo. *Rendiconti R. Inst. Lombardo di Sci. e Lett.*, ser. 2, vol. xxxiv (1901), p. 183. [Lamellibranchs, pp. 192—197.]

Alth, A. Geognostisch-palaeontologische Beschreibung der nächsten Umgebung von Lemberg. *Haidinger's Naturwiss. Abhandl.*, vol. iii, pt. ii (1850), p. 171. [Lamellibranchs, pp. 227—255.]

Anthula, D. J. Ueber die Kreidefossilien des Kaukasus, mit einem allgemeinen Überblick über die Entwicklung der Sedimentärbildungen des Kaukasus. *Beitr. z. Paläont. u. Geol. Osterr.-Ungarns u. d. Orients*, vol. xii, pts. 2, 3, Vienna (1899), p. 55. [Lamellibranchs, pp. 71—91.]

—— On the Middle Neocomian of Tzernovatz. *Ann. géol. Pénin. Balkan*, vol. vi (1903), p. 6. [Lamellibranchs, pp. 54—62.]

Archiac, A. d'. Mémoire sur la Formation Crétacé du sud-ouest de la France. *Mém. Soc. géol. de France*, vol. ii (1837), p. 157. [Lamellibranchs, pp. 181—189.]

—— Rapport sur les Fossiles du Tourtia. *Ibid.*, ser. 2, vol. ii (1847), p. 291. [Lamellibranchs, pp. 300—313.]

—— Coupe géologique des environs des Bains de Rennes (Aude), suivie de la description de quelques fossiles de cette localité. *Bull. Soc. géol. de France*, ser. 2, vol. xi (1854), p. 185. [Lamellibranchs, pp. 208—216.]

Arnaud, H. Position des *Hippurites dilatatus* et *Hippurites bioculatus* dans la série crétacée. *Bull. Soc. géol. de France*, ser. 3, vol. xii (1883), p. 138.

Baily, W. H. Descriptions of some Cretaceous Fossils from South Africa. *Quart. Journ. Geol. Soc.*, vol. xi (1855), p. 454. [Lamellibranchs, pp. 460—463.]

Barrois, C. Mémoire sur le Terrain Crétacé des Ardennes et des Régions voisines. *Annal. Soc. géol. du Nord*, vol. v (1878), p. 227. [Lamellibranchs, pp. 390, 391, 405—408, 419, 420, 474—479.]

—— Sur quelques espèces nouvelles ou peu connues du Terrain Crétacé du Nord de la France. *Ibid.*, vol. vi (1879), p. 449. [Lamellibranchs, pp. 452—456.]

Bayle, E. Observations sur la structure des coquilles de *Hippurites*, suivies de quelques remarques sur les Radiolites. *Bull. Soc. géol. de France*, ser. 2, vol. xii (1855), p. 772.

—— Observations sur le *Radiolites Jouanneti*. *Ibid.*, ser. 2, vol. xiii (1855), p. 102.

—— Observations sur le *Radiolites cornu-pastoris*. *Ibid.*, ser. 2, vol. xiii (1855), p. 139.

—— Observations sur le *Sphærulites foliaceus*. *Ibid.*, ser. 2, vol. xiii (1855), p. 71.

—— Nouvelles observations sur quelques espèces de Rudistes. *Ibid.*, ser. 2, vol. xiv (1857), p. 647.

—— Sur les Rudistes découverts dans la craie de Maëstricht. *Ibid.*, ser. 2, vol. xv (1858), p. 210, pl. iii.

—— Explication de la carte géologique de France. Vol. iv, Atlas, pt. 1. Fossiles principaux des Terrains. Paris, 1878. [Lamellibranchs, pls. ciii—cxlviii.]

—— and Coquand, H. Mémoire sur les fossiles secondaires recueillis dans le Chili. *Mém. Soc. géol. de France*, ser. 2, vol. iv (1851), p. 1. [Lamellibranchs, pp. 37, 38.]

Behrendsen, O. Zur Geologie des Ostabhanges der argentinischen Cordillere. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xliii (1891), p. 369. [Lamellibranchs, pp. 417—419.]

Behrens, G. Ueber die Kreideablagerungen auf der Insel Wollin. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxx (1878), p. 229. [Lamellibranchs, pp. 256—260.]

Blainville, H. M. D. de. Manuel de Malacologie et de Conchyliologie. Text 1825. Plates 1827. Paris. [Lamellibranchs, pp. 508—581.]

—— Dictionnaire des Sciences naturelles. Planches. *Conchyliologie et Malacologie*. Paris, 1816-30.

Blanckenhorn, M. Beiträge zur Geologie Syriens: Die Entwickelung des Kreidesystems in Mittel- und Nord-Syrien. Eine geognostisch-paläontologische Monographie. Cassel, 1890. [Lamellibranchs, pp. 71—97.]

Boehm, G. Beiträge zur Kenntniss der Hilsmulde. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxix (1877), p. 215. [Lamellibranchs, pp. 231—242.]

—— *Coralliochama*. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xliv (1892), p. 560.

—— Ueber *Cornucaprina*. *Neues Jahrb. für Min.*, etc. (1893), vol. ii, p. 129.

Boehm, G. Beitrag zur Kenntniss der Kreide in den Sudalpen. *Palæontographica*, vol. xli (1895), p. 81. [Lamellibranchs, pp. 96—132, 137—142.]

—— Beitrag zur Gliederung der Kreide in den Venetianer Alpen. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xlix (1897), p. 160. [Lamellibranchs, pp. 172—178.]

—— Ueber Caprinidenkalke aus Mexico. *Ibid.*, vol. l (1898), p. 323. [Lamellibranchs, pp. 324—330.]

—— Beiträge zur Kenntniss mexicanischer Capridenkalke. *Felix und Lenk's Beitr. z. Geol. u. Pal. d. Republ. Mexico*, pt. 2 (1899), p. 143. [Lamellibranchs, pp. 146—151.]

Böhm, J. Der Grünsand von Aachen und seine Mollusken-Fauna. *Verhandl. des naturhist. Vereines der preussisch. Rheinl.*, vol. xlii (1885), p. 1. [Lamellibranchs, pp. 75—147.]

—— Die Kreidebildungen des Fürbergs und Sulzbergs bei Siegsdorf in Oberbayern. *Palæontographica*, vol. xxxviii (1891), p. 1. [Lamellibranchs, pp. 70—93.]

—— Ueber cretacеische Gastropoden vom Libanon und vom Karmel. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. lii (1900), p. 189. [Lamellibranchs, p. 218.]

Borisiak, A. Sur les Aucelles du Crétacé inférieur de la Crimée. *Bull. Com. géol. St. Pétersbourg*, vol. xx (1901), p. 279.

Bosquet, J. Fossiele Fauna en Flora van het Krijt van Limburg. In W. C. H. Staring's *Natuurlijke Historie van Nederland. De Bodem van Nederland*, vol. ii (1860). Haarlem. [Lamellibranchs, pp. 376—388.]

Boule, M. Note sur les Fossiles rapportés de Madagascar par M. E. Gautier. *Bull. Mus. d'Hist. nat.*, vol. i (1895), p. 181. [Lamellibranchs, pp. 182, 185, 186.]

Boyle, C. B. A Catalogue and Bibliography of North American Mesozoic Invertebrata. *Bull. U. S. Geol. Survey, Washington*, No. 102 (1893). Part I, Bibliography; Part II, Alphabetical List of Species.

Brauns, D. Die senonen Mergel des Salzberges bei Quedlinburg und ihre organischen Einschlüsse. *Zeitschr. f. d. gesammt. Naturwissensch.*, vol. xlvi (1876), p. 325. [Lamellibranchs, pp. 357—395.]

Briart, A., and Cornet, F. L. Description minéralogique, géologique, et paléontologique de la Meule de Bracquegnies. *Mém. couron. et Mém. des savants étrang. Acad. Roy. Belg.*, vol. xxxiv (1868). [Lamellibranchs, pp. 45—84.]

Broili, F. Ueber die Fauna der Orbitolinen führenden Schichten der untersten Kreide in der Krim. *Abhandl. d. k. bayer. Akad. d. Wiss. München*, Cl. ii, vol. xxi (1902), p. 603. [Lamellibranchs, pp. 606—608.]

Bronn, H. G. *Hippurites*. In Ersch and Gruber's *Allgem. Encycl. d. Wissensch. u. Künste*, sect. ii, pt. 8 (1831), pp. 371—376.

—— Die Versteinerungen des Salza-Thales. *Jahrb. f. Min., Geogn., Geol., u. Petrefactenk.* [3], (1832), p. 150. [Lamellibranchs, pp. 172, 178.]

Bronn, H. G. Lethæa Geognostica oder Abbildungen und Beschreibung der für die Gebirgs-Formationen bezeichnendsten Versteinerungen. Vol. ii, Stuttgart, 1838. [Lamellibranchs, pp. 623—641, 667—705.]

—— —— *Ibid.* Third Edition (by Bronn and Römer). Vol. ii, pt. v (1851–2). [Lamellibranchs, pp. 240—305.]

—— Index Palæontologicus. Vol. i (1848); vol. ii (1849). Stuttgart.

Bruguière, J. G. Histoire naturelle des Vers et des Mollusques. *Encyclopédie méthodique*, Paris, 1789—1832. Vol. I, pp. 1—344 (1789), pp. 345—758 (1792). Vol. II, pp. 1—144 (1830), pp. 145—594 (1832). Vol. III (by Deshayes), pp. 595—1152 (1832). (For dates see Sherborn and Woodward, *Proc. Zool. Soc.*, 1899, p. 595.)

Buch, L. von. Pétrifications recueillies en Amérique par Mr. A. de Humboldt et par Charles Degenhardt. Berlin, 1839. (Also in von Buch's *Gesammelte Schriften*, vol. iv, pt. 2, 1885, p. 519.)

Burckhardt, C. Beiträge zur Kenntniss der Jura- und Kreideformation der Cordillere. *Palæontographica*, vol. l (1903), p. 1. [Cretaceous Lamellibranchs, pp. 70—84, pls. xii—xvi.]

Burckhardt, R. Le Gisement Supracrétacique de Roca (Rio Negro). *Rev. Mus. de la Plata*, vol. x (1901), p. 207. [Lamellibranchs, pp. 212—214.]

Buvignier, A. Statistique géologique, minéralogique, minérallurgique et paléontologique du département de la Meuse. With atlas. Paris, etc., 1852. [Lamellibranchs in atlas, pp. 8—26.]

Choffat, P. Description des Fossiles Crétaciques: Mollusques. In *P. Choffat et P. de Loriol*, Matériaux pour l'étude stratigraphique et paléontologique de la Province d'Angola. *Mém. Soc. Phys. et d'Hist. nat. de Genève*, vol. xxx, No. 2 (1888), p. 61. [Lamellibranchs, pp. 82—95.]

—— Bibliographie récente du group de *Ostrea Joannæ*. *Rev. Crit. Paléozool.* (1898), p. 179. Also *Comm. d. trabalhos geol. Portugal*, vol. iii (1898), p. 292.

—— Recueil d'études paléontologiques sur la Faune Crétacique du Portugal. Vol. i. Espèces nouvelles ou peu connues. Ser. 3. Mollusques du Sénonien à facies fluvio-marin. [Lamellibranchs, pp. 96—104.] Ser. 4. Espèces diverses. [Lamellibranchs, pp. 132—168.] 1901–2.

Collot, L. Description du Terrain crétacé dans une partie de la Basse-Provence. *Bull. Soc. géol. de France*, ser. 3, vol. xviii (1890), p. 49. [Brief Notes on Lamellibranchs, pp. 60, 61, 100—102.]

—— Sur les Trigonies byssifères. *Ibid.*, ser. 3, vol. xxvii (1899), p. 224.

Conrad, T. A. Notes on Shells, with descriptions of New Species. *Proc. Acad. Nat. Sci. Philad.*, vol. vi (1852), p. 199. [Lamellibranchs, p. 200.]

—— Notes on Shells. *Ibid.*, p. 320.

—— Descriptions of New Fossil Shells of the United States. *Journ. Acad. Nat. Sci. Philad.*, ser. 2, vol. ii, pt. 3 (1853), pp. 273—276. *Ibid.*, pt. 4 (1854), pp. 299, 300.

Conrad, T. A. Descriptions of Eighteen New Cretaceous and Tertiary Fossils, etc. *Proc. Acad. Nat. Sci. Philad.*, vol. vii (1855), p. 265. [Lamellibranchs, p. 266.]

—— Descriptions of One Tertiary and Eight New Cretaceous Fossils from Texas. *Ibid.*, p. 268.

—— Descriptions of Cretaceous and Tertiary Fossils. *Rep. U. S. and Mexican Boundary Survey*, vol. i, pt. 2 (1857), p. 141. [Lamellibranchs, pp. 147—157.]

—— Observations on a Group of Cretaceous Fossil Shells found in Tippah County, Miss., with descriptions of fifty-six new species. *Journ. Acad. Nat. Sci. Philad.*, ser. 2, vol. iii (1858), p. 323. [Lamellibranchs, pp. 324—330.]

—— Description of New Species of Cretaceous and Eocene Fossils of Mississippi and Alabama. *Journ. Acad. Nat. Sci. Philadelphia*, ser. 2, vol. iv, pt. iii (1860), p. 275. [Lamellibranchs, pp. 276—283.]

—— Descriptions of New Species of Cretaceous Fossils. *Ibid.*, p. 299. [Lamellibranchs, pp. 302—305.]

—— Descriptions of New Species of Tertiary, Cretaceous, and Recent Shells. *American Journ. Conch.*, vol. ii (1866), pp. 104, 105.

—— Descriptions of and References to Miocene Shells of the Atlantic Slope, and descriptions of two new supposed Cretaceous species. *Ibid.*, vol. iv (1868), p. 278.

—— Descriptions of New Fossil Mollusca, principally Cretaceous. *Ibid.*, vol. v (1870), pp. 96—103.

—— Descriptions of New Genera and Species of Fossil Shells of North Carolina in the State Cabinet at Raleigh. *Appendix to W. C. Kerr's Report Geol. Surv. N. Carolina*, vol. i (1875), Raleigh. [Lamellibranchs, pp. 2—11.]

—— Synopsis of the Cretaceous Mollusca of North Carolina. *Ibid.*, p. 13. [Lamellibranchs, pp. 13—16.]

Cooper, J. G. On some New Cretaceous (and Eocene?) Mollusca of California. *Proc. Californ. Acad. Sci.*, ser. 2, vol. vi (1896), p. 330, pls. xlvii, xlviii.

Coquand, H. Notice sur les richesses paléontologiques de la province de Constantine. *Journ. de Conchyl.*, vol. iii (1852), p. 418. [Lamellibranchs, pp. 433, 434.]

—— Synopsis des animaux et des végétaux fossiles observés dans la formation crétacée du sud-ouest de la France. *Bull. Soc. géol. de France*, ser. 2, vol. xvi (1859), p. 945. [Lamellibranchs, pp. 957—962, 969, 970, 975, 976, 982—985, 909—1008, 1017, 1018.]

—— Description physique, géologique, paléontologique, et minéralogique du département de la Charente, 2 vols. Vol. I. Besançon, 1858. Vol. II. Marseille, 1860. [Lamellibranchs, vol. ii, pp. 102—109, 119—121, 123—125, 128—131, 140—145, 164—177.]

—— Géologie et Paléontologie de la Région sud de la Province de Constantine. With Atlas, 1862. [Lamellibranchs, pp. 189—235, pls. vi—xxiii.]

Coquand, H. Monographie de l'Étage Aptien de l'Espagne. Marseille, 1865. [Lamellibranchs, pp. 87—170.]

—— Monographie du genre *Ostrea*. Marseille, 1869.

Cotteau, G. Études sur les Mollusques Fossiles du département de l'Yonne. *Bull. Soc. Sci. Yonne*, vols. vi—xi, 1852–57. [Lamellibranchs (in vol. ix), pp. 48—124, 1855.]

Cragin, F. W. Contributions to the Palæontology of the Plains, No. 1. *Bull. Washburn Coll. Lab.*, vol. ii, No. 10 (1889), p. 65. [Lamellibranchs, pp. 67, 68.]

Credner, H. Die Kreide von New Jersey. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xx (1870), p. 191. [Lamellibranchs, pp. 225—237.]

Cuvier, G., and A. Brongniart. Description géologique des couches des environs de Paris, etc., in Cuvier, Recherches sur les Ossemens Fossiles, vol. ii, pt. 2 (June, 1822). Paris. [Lamellibranchs, pp. 597—604, 608, 609.]

Dainelli, G. Appunti geologici sulla parte meridionale de Capo di Leuca. *Boll. Soc. geol. Italiana*, vol. xx (1901), p. 616. [Lamellibranchs, pp. 642—651.]

Daintree, R., see R. Etheridge.

Dames, W. Ueber *Ptychomya*. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxv (1873), p. 374.

—— Ueber Diluvialgeschiebe cenomanen Alters. *Ibid.*, vol. xxvi (1874), p. 76. [Lamellibranchs, pp. 762–6.]

Defrance, M. J. L. Dictionnaire des Sciences naturelles . . . par plusieurs Professeurs du Jardin du Roi, et des principales Écoles de Paris. Strasbourg and Paris, 61 vols., 1816–45.

Deicke, H. Beiträge zur geognostischen und paläontologischen Beschaffenheit der unteren Ruhrgegend. Erster Beitrag: Die Tourtia in der Umgegend von Mülheim a. d. Ruhr (*Beilage zum 23 Jahresberichte der Realschule I. Ordnung zu Mülheim an der Ruhr*), 1876. [Lamellibranchs, pp. 25—29.]

Deshayes, G. P. Traité Elémentaire de Conchyliologie, avec les Applications de cette science à la Geologie. 2 vols. Paris, 1839–53.

—— and Milne-Edwards, H., see Lamarck.

Dieulafait, L. Position de l'*Ostrea Couloni* dans le Néocomien du sud-est de la France. *Bull. Soc. géol. de France*, ser. 2, vol. xxvii (1870), p. 431.

Dixon, F., see J. de C. Sowerby.

Donciieux, L. Monographie géologique et paléontologique des Corbières Orientales. *Annal. de l'Univers. de Lyon*, n. s., fascic. 11 (1903). [Lamellibranchs, pp. 307—310.]

Douvillé, H. Essai sur la Morphologie des Rudistes. *Bull. Soc. géol. de France*, ser. 3, vol. xiv (1886), p. 389.

Douvillé, H. Sur quelques formes peu connues de la famille des Chamidæ. *Ibid.*, ser. 3, vol. xv (1887), p. 756.

—— Études sur les Caprines. *Ibid.*, ser. 3, vol. xvi (1888), p. 699.

—— Sur quelques Rudistes du terrain crétacé inférieur de Pyrénées. *Ibid.*, ser. 3, vol. xvii (1889), p. 627.

—— Études sur les Rudistes. Révision des principales espèces d'Hippurites. *Mém. Soc. géol. de France*, Palcont., vol. i, no. 6 (1890), pls. xv—xvii.

—— Sur les caractères internes des *Sauvagesia*. *Bull. Soc. géol. de France*, ser. 3, vol. xix (1891), p. 669.

—— Etudes sur les Rudistes. V. Sur les Rudistes du Gault supérieur du Portugal. *Ibid.*, ser. 3, vol. xxvi (1898), p. 140.

—— Sur les Couches à Rudistes du Texas. *Ibid.*, ser. 3, vol. xxvi (1898), p. 387.

—— Sur quelques Rudistes américains. *Ibid.*, ser. 3, vol. xxviii (1900), p. 205.

—— Sur la distribution géographique des Rudistes, des Orbitolines et des Orbitoides. *Ibid.* (1900), p. 222.

—— Classification des Radiolites. *Ibid.*, ser. 4, vol. ii (1902), p. 461, pl. xv.

—— Sur un nouveau genre de Radiolites. *Ibid.* (1902), p. 478, pl. xv.

—— Sur le genre *Chondrodonta*, Stanton. *Ibid.* (1902), p. 314.

Drescher, R. Ueber die Kreide-Bildungen der Gegend von Löwenberg. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xv (1863), p. 291. [Lamellibranchs, pp. 341—357.]

Drouet, C. Sur un nouveau genre de coquille [*Neithea*] de la famille des Arcacées, et description d'une nouvelle espèce de Modiole fossile. *Mém. Soc. Linn. de Paris*, vol. iii (1824), p. 183, pl. vii.

Dujardin, F. Mémoire sur les couches du Sol en Touraine, et description des coquilles de la Craie des Faluns. *Mém. Soc. géol. de France*, vol. ii (1837), p. 211. [Lamellibranchs, pp. 223—230.]

Eichwald, E. v. Ueber die Neocomschichten Russlands. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xviii (1866), p. 245. [Lamellibranchs, pp. 259—263, 270—273.]

—— Lethæa Rossica ou Palcontologie de la Russie. Vol. ii (Période moyenne). With Atlas. Stuttgart, 1866–9 (pp. 1—224, 1866; 225—832, 1868; 833—1304, 1869). [Lamellibranchs, pp. 355—797.]

Elbert, J. Das untere Angoumien in den Osningbergketten des Teutoburger Waldes. *Verh. nat. Ver. d. preussisch. Rheinl., etc.*, vol. lviii (1902), p. 77. [Lamellibranchs, pp. 108—112.]

Etheridge, R. Description of the Palæozoic and Mesozoic Fossils of Queensland. [Appendix I to *R. Daintree's* Notes on the Geology of the Colony of Queensland.] *Quart. Journ. Geol. Soc.*, vol. xxviii (1872), p. 317. [Lamellibranchs, pp. 338—344.]

ETHERIDGE, R. In PENNING, W. H., and JUKES-BROWNE, A. J. The Geology of the Neighbourhood of Cambridge. With a Palæontological Appendix by R. Etheridge. *Mem. Geol. Survey*, 1881. [Lamellibranchs, pp. 141—147.]

ETHERIDGE, R., jun. A Catalogue of Australian Fossils (including Tasmania and the Island of Timor). Cambridge, 1878. [Lamellibranchs, pp. 106—113.]

—— The Cretaceous Mollusca of South Australia and the Northern Territory. *Mem. Roy. Soc. South Australia*, vol. ii, pt. i (1902). [Lamellibranchs, pp. 8—39.]

—— *See* JACK, R. L.

EUDES-DESLONGSCHAMPS, J. A. Essai sur les Plicatules fossiles des Terrains du Calvados, et sur quelques autres genres voisins ou démembrés de ces coquilles. *Mém. Soc. Linn. de Normand.*, vol. xi (1858), p. 1.

EVANS, J., and SHUMARD, B. F. On some New Species of Fossils from the Cretaceous Formation of Nebraska Territory. *Trans. Acad. Sci. St. Louis*, vol. i (1857), p. 38. [Lamellibranchs, pp. 38—40.]

EWALD, J. Ueber die Grenze zwischen Neocomien und Gault. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. ii (1850), p. 440. [Lamellibranchs, pp. 469–71.]

—— *Exogyra columba*. *Ibid.*, vol. ix (1857), p. 12.

—— Ueber die Fossile Fauna des unteren Gault bei Ahaus in Westphalen. *Monatsberichte d. k. preuss. Akad. d. Wissensch. zu Berlin*, 1860 (1861), p. 332. [Lamellibranchs, pp. 344—346.]

FAUJAS-SAINT-FOND, B. Histoire naturelle de la Montagne de Saint-Pierre de Maestricht. Paris, 1779.

FAVRE, E. Description des Mollusques fossiles de la Craie des Environs de Lemberg en Galicie. Genève et Bâle, 1869. [Lamellibranchs, pp. 102—163.]

FELIX, J. Versteinerungen aus der mexicanischen Jura- und Kreide-Formation. *Palæontographica*, vol. xxxvii (1891). [Lamellibranchs, pp. 163—168.] Also published in Felix and Lenk's *Beitr. z. Geol. u. Pal. Republ. d. Mexico*, pt. 3 (1891), p. 140.

FITTON, W. H., see J. DE C. SOWERBY.

FORBES, E. Report on the Fossils from Santa Fé de Bogota, presented to the Geological Society by Evan Hopkins. *Quart. Journ. Geol. Soc.*, vol. i (1845), p. 174. [Lamellibranchs, p. 179.]

—— On the Fossil Shells collected by Mr. Lyell from the Cretaceous Formations of New Jersey. *Ibid.*, vol. i (1845), p. 61.

—— Catalogue of Lower Greensand Fossils in the Museum of the Geological Society. Part I. Acephala Lamellibranchiata. *Ibid.*, vol. i (1845), p. 237.

—— Report on the Fossil Invertebrata from Southern India, collected by Mr. Kaye and Mr. Cunliffe. *Trans. Geol. Soc.*, ser. 2, vol. vii, pt. 3 (1846), p. 97. [Lamellibranchs, pp. 139—157.]

Fraas, O. Geologisches aus dem Orient. *Jahresh. Ver. vat. Naturk. in Württ.*, vol. xxiii (1867), p. 145. [Lamellibranchs, pp. 229—239.]

—— Geologisches aus dem Libanon. *Ibid.*, vol. xxxiv (1878), p. 257. [Lamellibranchs, pp. 299—302, 326—328.]

—— Aus dem Orient. I. Geologische Beobachtungen am Nil, auf der Sinai-Halbinsel und in Syrien. Stuttgart, 1867. [Lamellibranchs, pp. 86—95.] II. Geologische Beobachtungen am Libanon. Stuttgart, 1878. (A reprint of the two preceding papers.)

Franchis, F. de. Molluschi della Creta media del Lecesse. *Boll. Soc. géol. Ital.*, vol. xxii (1903), p. 147. [Lamellibranchs, pp. 155—164.]

Frech, F. Die Versteinerungen der unter-senonen Thonlager zwischen Suderode und Quedlinburg. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxxix (1887), p. 141. [Lamellibranchs, pp. 151—174.]

—— Ueber *Gervilleia*. *Centralbl. f. Min.*, etc. (1902), p. 609.

Fritsch, A. Studien im Gebiete der böhmischen Kreideformation. II. Die Weissenberger und Malnitzer Schichten. (*Archiv f. d. naturwiss. Landesdurchforschung von Böhmen* (Prag), vol. iv, 1877.) [Lamellibranchs, pp. 112—143.]

—— *Ibid.* III. Die Iserschichten. (*Ibid.*, vol. v, 1883.) [Lamellibranchs, pp. 97—122.]

—— *Ibid.* IV. Die Teplitzer Schichten. (*Ibid.*, vol. vii, 1889.) [Lamellibranchs, pp. 75—87.]

—— *Ibid.* V. Priesener Schichten. (*Ibid.*, vol. ix, 1893.) [Lamellibranchs, pp. 91—102.]

—— *Ibid.* VI. Die Chlomeker Schichten. (*Ibid.*, vol. x, 1897.) [Lamellibranchs, pp. 50—68.]

—— and Bayer, E. *Ibid.* VII. Perucer Schichten. (*Ibid.*, vol. xi, 1901.) [Lamellibranchs, p. 165.]

Futterer, K. Die Oberen Kreidebildungen der Umgebung des Lago di Santa Croce in den Venetianer Alpen. *Palæont. Abhandl.*, vol. vi (1892). [Lamellibranchs, pp. 77—106.]

—— Ueber einige Versteinerungen aus der Kreideformation der Karnischen Voralpen. *Ibid.*, vol. vi (1896), pp. 10—22, 25—28.

Gabb, W. M. Descriptions of some New Species of Cretaceous Fossils. *Journ. Acad. Nat. Sci. Philad.*, ser. 2, vol. iv (1860), p. 299. [Lamellibranchs, pp. 303—305.]

—— Descriptions of New Species of American Tertiary and Cretaceous Fossils. *Ibid.*, ser. 2, vol. iv, pt. iv (1860), p. 375. [Lamellibranchs, pp. 393—398, 403.]

—— Synopsis of the Mollusca of the Cretaceous Formation, including the Geographical and Stratigraphical Range and Synonymy. *Proc. Amer. Phil. Soc.*, vol. viii (1861), p. 57. [Lamellibranchs, pp. 150—245.]

Gabb, W. M. Descriptions of New Species of Cretaceous Fossils from New Jersey, Alabama, and Mississippi. *Proc. Acad. Nat. Sci. Philad.*, vol. v (1861) p. 318, [Lamellibranchs, pp. 323—329.]

—— Notes on Cretaceous Fossils, with descriptions of a few additional new species. *Ibid.*, p. 363. [Lamellibranchs, pp. 364—367.]

—— Geological Survey of California. *Palæontology.*
Vol. I, sect. iv. Description of the Cretaceous Fossils (1864), p. 57. [Lamellibranchs, pp. 145—217.]
Vol. II, sect. ii. Cretaceous Fossils (1869). [Lamellibranchs, pp. 175—203, 233—253.]
— sect. iii. Cretaceous Fossils from Mexico (1869). [Lamellibranchs, pp. 265—275.]

—— Notice of a Collection of Cretaceous Fossils from Chihuahua, Mexico. *Proc. Acad. Nat. Sci. Philad.*, vol. v (1872), p. 263. [Lamellibranchs, p. 264.]

—— Notes on American Fossils, with descriptions of some new species. *Ibid.*, vol. vi (1876), p. 276. [Lamellibranchs, pp. 304—323.]

—— Description of a Collection of Fossils made by Dr. Antonio Raimondi in Peru. *Journ. Acad. Nat. Sci. Philadelphia*, ser. 2, vol. viii, pt. 3 (1877), p. 263. [Lamellibranchs, pp. 282—298.]

Gagel, C., and Kaunhowen, F. Ueber ein Vorkommen von Senonen Kreide in Ostpreussen. *Jahrb. d. k. preussisch. geol. Landesanst.* für 1899 (1900), p. 227. [Lamellibranchs, pp. 229—233.]

Gardner, J. S. British Cretaceous Nuculidæ. *Quart. Journ. Geol. Soc.*, vol. xl (1884), p. 120.

Gaudry, A. Sur la découverte de l'*Ostrea Leymerii* à Wissant. *Bull. Soc. géol. de France*, ser. 2, vol. xvii (1860), p. 30.

Geinitz, H. B. Charakteristik der Schichten und Petrefacten des sächsischen Kreidegebirges. Pt. 1. Dresden and Leipzig (1839). [Lamellibranchs, pp. 17—28.]

—— *Ibid.* Pt. 2 (1840). [Lamellibranchs, pp. 49—60.]

—— Charakteristik der Schichten und Petrefacten des sächsisch-böhmischen Kreidegebirges. Pt. 3. Dresden and Leipzig (1842). [Lamellibranchs, pp. 75—85.]

—— Die Versteinerungen von Kieslingswalda und Nachtrag zur Charakteristik des sächsisch-böhmischen Kreidegebirges. Dresden and Leipzig (1843). [Lamellibranchs, pp. 11—17.]

—— Grundriss der Versteinerungskunde. Dresden and Leipzig, 1845–46. [Lamellibranchs, pp. 391—488.]

—— Das Quadersandsteingebirge oder Kreidegebirge in Deutschland. Freiburg, 1849–50. Pp. 1—96, pls. i—vi, 1849; 97—end, pls. vii—xii, 1850.

—— Das Elbthalgebirge in Sachsen. *Palæontographica*, vol. xx, pt. 1, pp. 169—206 (1872); 207—236 (1873); pt. ii, pp. 29—52 (1872); 53—72 (1873).

GEINITZ, H. B. Über Inoceramen der Kreideformation. *Neues Jahrb. für Min.*, etc. (1873), p. 7.

GERHARDT, K. Beiträge zur Geologie und Paleontologie von Südamerika. V. Beitrag zur Kenntniss der Kreideformation in Venezuela und Peru. *Ibid.* Beilage-Band xi (1897), pp. 96—116. VI. Beitrag zur Kenntniss der Kreideformation in Columbien. *Ibid.*, pp. 161—163, 175—189, 201.

GIEBEL, C. G. Deutschlands Petrefacten. Ein systematisches Verzeichniss aller in Deutschland und der angrenzenden Ländern vorkommenden Petrefacten nebst Angabe der Synonyme und Fundorte. Leipzig, 1852. [Lamellibranchs, pp. 329—441.]

—— Beiträge zur Paläontologie. Berlin, 1853. II. Beitrag zur Paläontologie des texanischen Kreidegebirges, p. 72. [Lamellibranchs, pp. 79—86.] (Reprinted from *Jahresber. naturwiss. Vereines in Halle*, vol. v.)

GOLDFUSS, A. Petrefacta Germaniæ. 3 vols. Dusseldorf, 1827–44. [Lamellibranchs, vol. ii, pp. 1—68 (1833); 69—140 (1836); 141—224 (1837); 225—312 (1840).]

GOSSELET, J. Esquisse géologique du Nord de la France, etc. Fasc. 2, pls. xiv—xxi. Lille, 1881.

GRANGE, J. *See* D'ORBIGNY.

GRAS, A. Catalogue des Corps organisés fossiles dans le département de l'Isère. *Bull. Soc. Statist. Isère*, ser. 2, vol. ii, 1852. [Lamellibranchs, pp. 30—32, 33, 39, 42, 43, 44, 50.]

GRAY, J. E. On a Peculiar Structure in Shells; with some Observations on the Shell in *Sphærulites*. *Mag. Zool. and Bot.*, vol. ii (1838), p. 228, pl. viii.

GRIEPENKERL, O. Die Versteinerungen der Senonen Kreide von Königslutter im Herzogthum Braunschweig. *Palæont. Abhandl.*, vol. iv (1889). [Lamellibranchs, pp. 33—70.]

GRIESBACH, C. L. On the Geology of Natal in South Africa. *Quart. Journ. Geol. Soc.*, vol. xxvii (1871), p. 53. [Lamellibranchs, pp. 65—67.]

GRÖNWALL, K. A Släktet *Dimyodon* i Danmarks krita. *Meddel. fra Dansk geol. Foren.*, No. 6 (1900), p. 73.

GROSSOUVRE, A. DE. Sur le Terrain Crétacé dans le sud-ouest du bassin de Paris. *Bull. Soc. géol. de France*, ser. 3, vol. xvii (1889), p. 475. [Lamellibranchs, pp. 522—524, pl. xi.]

GUÉRANGER, E. Album Paléontologique du département de la Sarthe. Le Mans. 1867. [Lamellibranchs, pls. xv—xxv.]

GUÉRIN-MENEVILLE, F. E. Iconographie du Règne Animal de Cuvier, vol. ii, pt. 3, plates xxiv—xxxiii; vol. iii, Mollusques, pp. 40—52. 1829–43.

GUISCARDI, G. Sur le *Sphærulites Tenoreana*. *Bull. Soc. géol. de France*, ser. 2, vol. xix (1862), p. 1031.

—— Studii sulla famiglia della Rudiste. *Rendiconto d. Accad. Sci. Fis. e Math. (Soc. R. Napoli)*, vol. ii (1863), p. 282.

Gümbel, C. W. Geognostische Beschreibung der Königreichs Bayern, vol. ii, Gotha (1868), pp. 764—769.

Haenlein, C. v. Ueber gefurchte *Cripsii*-Formen in subhercynischen Untersenon. *Schrift. Naturwiss. Vereins des Harzes in Wernigerode*, vol. x (1895), p. 116.

Hagenow, F. v. Monographie der Rügen'schen Kreide-Versteinerungen. III. Mollusken. *Neues Jahrb. für Min., etc.* (1842), p. 528. [Lamellibranchs, pp. 545—563.]

Hall, J., and Meek, F. B. Descriptions of New Species of Fossils from the Cretaceous of Nebraska. *Mem. Amer. Acad. Arts and Sci.* (Camb. and Boston, 1855), p. 379. [Lamellibranchs, pp. 380—388.]

Hamlin, C. E. Results of an Examination of Syrian Molluscan Fossils, chiefly from Mount Lebanon. *Mem. Mus. Comp. Zool.*, vol. x, No. 3 (1884). [Lamellibranchs, pp. 38—64.]

Harris, G. D. The Lignitic Stage. I. Stratigraphy and Pelecypoda. *Bull. Amer. Pal.*, vol. ii, No. 9 (1897). [Lamellibranchs, pp. 37—74, pls i—xiv.]

Hauer, F. v. Ueber *Caprina Partschii* eine neue Bivalve aus dem Gosauschichten der österreichschen Alpen. *Haidinger's Naturwiss. Abhandl.*, vol. i (1847), p. 109.

Hébert, E. Note sur les caractères paléontologiques de la craie de Meudon. *Bull. Soc. géol. de France*, ser. 2, vol. xvi (1859), p. 143. [Notes on Lamellibranchs.]

—— Remarques sur quelques Fossiles de la Craie du Nord de l'Europe. *Ibid.*, ser. 3, vol. vi (1879), p. 317. [Lamellibranchs, p. 318.]

—— et Toucas, A. Matériaux pour servir à la description du Terrain Crétacé supérieur en France. Description du Bassin d'Uchaux. *Ann. Sci. géol.*, vol. vi (1875), No. 2. [Lamellibranchs, pp. 118—122.]

Heilprin, A. The Geology and Palæontology of the Cretaceous Deposits of Mexico. *Proc. Acad. Nat. Sci. Philadelphia*, 1890 (1891), p. 445, pls. xii—xiv. [Notes on Lamellibranchs.]

Hennig, A. Om Ahussandstenen. *Geol. Fören. i Stockholm Förhandl.*, vol. xvi (1894), p. 492. [Lamellibranchs, pp. 513—525.]

—— Revision af Lamellibranchiaterna i Nilsson's "Petrificata Suecana Formationis Cretaceæ." *Kon. Fysiogr. Sällsk. i Lund. Handl.*, N. F., vol. viii (1897).

—— Faunan i Skånes Yngre Krita. II. Lamellibranchiaterna. *Bih. K. Svenska Vet. Akad. Handl.*, vol. xxiv, No. 7 (1899).

Hilber, V. *Pironæa slavonica*. *Jahrb. d. k. k. geol. Reichsanst.* (Wien), vol. li (1901), p. 169.

—— Fossilien der Kainacher Gosau. *Ibid.*, vol. lii (1903), p. 277. [Lamellibranchs, pp. 280—283.]

Hill, R. T. Palæontology of the Cretaceous Formations of Texas. Part I. (*Univ. of Texas School of Geol.*) 1889. [Lamellibranchs, pl. i.]

—— *Ibid.* The Invertebrate Palæontology of the Trinity Division. *Proc. Biol. Soc. Washington*, vol. viii (1893), p. 9. [Lamellibranchs, pp. 22—32.]

—— *Ibid.* The Invertebrate Fossils of the *Caprina* Limestone Beds. *Proc. Biol. Soc. Washington*, vol. viii (1893), p. 97. [Lamellibranchs, pp. 105—108.]

—— Geography and Geology of the Black and Grand Prairies, Texas. 21*st Ann. Rep. U. S. Geol. Surv.*, pt. vii (1901). [Lamellibranchs, pls. xxxvii, xl, xliv, xlv, xlviii.]

—— and Vaughan, T. W. The Lower Cretaceous Gryphæas of the Texas Region. *Bull. U. S. Geol. Survey*, No. 151 (1898), pls. i—xxx.

Hisinger, W. Lethæa Suecica seu Petrificata Sueciæ iconibus et characteribus illustrata. Holmiæ, 1837. [Lamellibranchs, pp. 46—68.]

Hœrnes, R. *Chondrodonta* (*Ostrea*) *Joannæ*, Choffat, in den Schiosischichten von Görz, Istrien, Dalmatien, und der Hercegovina. *Sitz. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl.*, vol. cxi (1902), p. 667.

Hollick, A. The Palæontology of the Cretaceous Formation on Staten Island. *Trans. New York Acad. Sci.*, vol. xi (1892), p. 96. [Lamellibranchs, pl. i.]

Holzapfel, E. Die Mollusken der Aachener Kreide. III. Lamellibranchiata. *Palæontographica*, vol. xxxv (1889), pp. 139—263.

Hombres-Firmas, L. A. d'. Recueil de mémoires et d'observations de Physique, de Météorologie, d'Agriculture, et d'Histoire naturelle (1838), p. 169. [Mémoire sur les Hippurites et les Sphérulites du département du Gard.] Also *Bull. Soc. géol. France*, vol. ix (1838), p. 190.

Hommaire de Hell, X., see d'Orbigny.

Hudleston, W. H. Notes on some Mollusca from South Australia, obtained near Mount Hamilton and the Peak Station. *Geol. Mag.* (1884), p. 339 (? Cretaceous). [Lamellibranchs, pp. 340—342.]

—— Further Notes on some Mollusca from South Australia. *Ibid.* (1890), p. 241 (? Cretaceous). [Lamellibranchs, pp. 244—246.]

Imkeller, H. Die Kreidebildungen und ihre Fauna am Stallauer Eck und Enzenauer Kopf bei Tölz. *Palæontographica*, vol. xlviii (1901), p. 1. [Lamellibranchs, pp. 30—48.]

Jack, R. L., and R. Etheridge, jun. The Geology and Palæontology of Queensland and New Guinea. Brisbane and London (1892). [Cretaceous Lamellibranchs, pp. 445—483, 561—573.]

Jimbō, K. Beiträge zur Kenntniss der Fauna der Kreideformation von Hokkaidō. *Palæont. Abhandl.*, vol. vi (1894), pp. 42—44.

Johnson, C. W. New Cretaceous Fossils from an Artesian Well-boring at Mount Laurel, N.J. *Proc. Acad. Nat. Sci. Philad.*, 1898 (1899), p. 461. [Lamellibranchs, p. 464.]

Jukes-Browne, A. J. On the Relations of the Cambridge Gault and Greensand. *Quart. Journ. Geol. Soc.*, vol. xxxi (1875), p. 256. [Lamellibranchs, pp. 295—300.]

—— Supplementary Notes on the Fauna of the Cambridge Greensand. *Ibid.*, vol. xxxiii (1877), p. 485. [Lamellibranchs, pp. 500—503.]

—— On a Collection of Fossils from the Upper Greensand in the Dorset County Museum. *Proc. Dorset Nat. Hist. and Antiq. Field Club*, vol. xvii (1896), p. 96. [Lamellibranchs, pp. 105, 106.]

—— The Cretaceous Rocks of Britain. Vol. I. The Gault and Upper Greensand of England. (*Mem. Geol. Survey*, 1900.) [Lamellibranchs, pp. 448—452.] Vol. III. The Upper Chalk (in the Press) [Lamellibranchs, pp. 448—455.]

—— and Hill, W. A Delimitation of the Cenomanian; being a Comparison of the Corresponding Beds in South-western England and Western France. *Quart. Journ. Geol. Soc.*, vol. lii (1896), p. 99. [Notes on Lamellibranchs, pp. 149—155.]

—— and Milne, J. On the Cretaceous Fossils found at Moreseat, Aberdeenshire. *Geol. Mag.* (1898), p. 21. [Lamellibranchs, p. 29.]

Karsten, H. Ueber die Geognostischen Verhältnisse des Westlichen Columbien, der heutigen Republiken New-Granada und Equador. *Amtlicher Bericht über die zwei und dreissigster Versamml. Deutsch. Naturf. Ärzte zu Wien*, 1856.

—— Géologie de l'ancienne Columbie Bolivarienne Vénézuela, Nouvelle-Grenade et Ecuador. Berlin, 1886.

Keeping, W. The Fossils and Palæontological Affinities of the Neocomian Deposits of Upware and Brickhill. Cambridge, 1883. [Lamellibranchs, pp. 100—128, 150—153, 154.]

Keyserling, A. Wissenschaftliche Beobachtungen auf einer Reise in das Petschora-Land im Jahre 1843. St. Petersburg, 1846. [Lamellibranchs, pp. 294—316.]

Kiesow, J. Ueber Cenomanversteinerungen aus dem Diluvium der Umgegend Danzig's. *Schriften d. naturf. Gesellsch. in Danzig.* N.F., vol. v (1881), p. 404. [Lamellibranchs, pp. 410—416.] Vol. v (1882), p. 236. [Lamellibranchs, pp. 239—241.]

Kilian, W. Études Paléontologiques sur les Terrains Secondaires et Tertiaires de l'Andalousie. *Mém. Acad. Sci. France*, ser. 2, vol. xxx (1889), p. 601. [Lamellibranchs, p. 702.]

—— and Paquier, V. Note sur une faune crétacée provenant de Plewna (Bulgarie du Nord). *Arch. Sci. phys. et nat.* Période IV, vol. iv (1897), p. 144.

Kner, R. Versteinerungen des Kreidemergels von Lemberg und seiner Umgebung. *Haidinger's Naturwissensch. Abhandl.*, vol. iii, pt. 2 (1850), p. 1. [Lamellibranchs, pp. 24—31.]

— Neue Beiträge zur Kenntniss der Kreideversteinerungen von Ost-Galizien. *Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl.*, vol. iii (1852), p. 293. [Lamellibranchs, pp. 310—320.]

Koch, C. L. Ueber einige neue Versteinerungen und die *Perna Mulleti*, Desh., aus dem Hilsthon vom Elligser Brink und von Holtensen im Braunschweig'schen. *Palæontographica*, vol. i (1848), p. 169. [Lamellibranchs, pp. 170, 171.]

Koenen, A. von. Über Fossilien der unteren Kreide am Ufer des Mungo in Kamerun. *Abhandl. d. k. Gesellsch. d. Wiss. in Göttingen*, N. F., vol. i (1897). [Lamellibranchs, pp. 17—45.]

Kossmat, F. Über einige Kreideversteinerungen vom Gabun. *Sitzung. d. k. Akad. Wissensch. Wien, Math.-nat. Classe*, vol. cii (1893), p. 575. [Lamellibranchs, pp. 579—585.]

—— The Cretaceous Deposits of Pondicherri. *Records Geol. Surv. India*, vol. xxx (1897), p. 51. [Lamellibranchs, pp. 92—95.]

Krause, P. G. Über Tertiäre, Cretaceische und Ältere Ablagerungen aus West Borneo. *Samml. geol. Reichs-Museums in Leiden*, vol. v, No. 23 (1897), p. 169. [Lamellibranchs, p. 183.]

Krauss, F. Ueber die geologischen Verhältnisse der östlichen Küste des Kaplandes, etc. *Amtl. Ber. 20 Versamml. d. Gesellsch. deutsch. Naturf. u. Aerzte zu Mainz* im Sept. 1842 (1843), p. 126. [Lamellibranchs, pp. 129, 130.]

—— Ueber einige Petrefacten aus der untern Kreide des Kaplandes. *Nov. Act. Acad. Cæsar. Leopol.-Carol. Nat. Curios.*, vol. xxii (1850), p. 439. [Lamellibranchs, pp. 445—462.]

Kunth, A. Ueber die Kreidemulde bei Lähn in Nieder-Schlesien. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xv (1863), p. 714. [Lamellibranchs, pp. 724—727, 729, 732.]

Lahusen, J. Die Inoceramen-Schichten an dem Olenek und der Lena. *Mém. Acad. Imp. Sci. St. Petersb.*, ser. vii, vol. xxxiii, No. 7 (1886). [Lamellibranchs, pp. 3—7.]

—— Ueber die russischen Aucellen. *Mém. du Comité géol. Russ.*, vol. viii, No. 1 (1888), pls. i—v.

Lamarck, J. B. de. Histoire Naturelle des Animaux sans Vertèbres, etc. 7 vols. Paris, 1815–22. [Lamellibranchs, vol. v (1818), pp. 424—612; vol. vi (1819), pp. 1—235.]

—— —— *Ibid.*, ed. 2 (by G. P. Deshayes and H. Milne-Edwards), vol. vi, 1835; vol. vii, 1836.

Lamplugh, G. W. On the Subdivisions of the Speeton Clay. *Quart. Journ. Geol. Soc.*, vol. xlv (1889), p. 575. [Lamellibranchs, pp. 615, 616.]

Lanza, F. Essai sur les formations géognostiques de la Dalmatie et sur quelques nouvelles espèces de *Radiolites* et d'*Hippurites*. *Bull. Soc. géol. de France*, ser. 2, vol. xiii (1855), p. 127.

Lea, I. Descriptions of New Fossil Mollusca from the Cretaceous Formation at Haddonfield, New Jersey. *Proc. Acad. Nat. Sci. Philad.*, ser. 2, vol. v (1861), p. 148.

—— Descriptions of Unionidæ from the Lower Cretaceous Formation of New Jersey. *Ibid.*, vol. xii (1868), p. 162.

Leney, F. A List of the Type, Figured, and Described Fossils in the Norwich Castle Museum. *Geol. Mag.* (1902), pp. 166, 220. [Lamellibranchs, pp. 228, 229.]

Leonhard, R. Die Fauna der Kreideformation in Oberschlesien. *Palæontographica*, vol. xliv (1897), p. 11. [Lamellibranchs, pp. 26—28, 45—53.]

Leymerie, A. Suite du Mémoire sur le Terrain Crétacé du Département de l'Aube. Part II (Paléont.). *Mém. Soc. géol. de France*, vol. v (1842), p. 1. [Lamellibranchs, pp. 2—11.]

—— Statistique géologique et minéralogique du département de l'Aube. Atlas. Troyes, Paris, and London, 1846. [Lamellibranchs, pp. 8—12, pls. iv—viii.]

Liebus, A. Über einige Fossilien aus der Karpathischen Kreide. *Beitr. z. Paläont. u. Geol. Österr.-Ungarns u. d. Orients*, vol. xiv (1902), p. 113. [Lamellibranchs, p. 116.)

Logan, W. N. Some Additions to the Cretaceous Invertebrates of Kansas. *Kansas Univ. Quarterly*, vol. viii, ser. A (1899), p. 87. [Lamellibranchs, pp. 88—98.]

Longhi, P. Di una varietà *Caprina schiosensis*. *Riv. ital. Pal.*, vol. vi (1900), p. 88.

—— Contribuzione alla conoscenza della Fauna del calcare cretaceo di Calloneghe presso il Lago di S. Croce nelle Alpi venete. *Ibid.*, vol. ix (1903), p. 22. [Lamellibranchs, pp. 28—31.]

Loriol, P. de. Description des Animaux Invertébrés Fossiles contenus dans l'étage Néocomien moyen du Mont Salève. Genève and Bâle. Part I, 1861; Part II, 1863. [Lamellibranchs (1861), pp. 50—112.]

—— Description des Fossiles de l'Oolithe Corallienne, de l'étage Valangien et de l'étage Urgonien du Mont Salève. Genève, 1866. [Lamellibranchs, pp. 62, 63, 72—85.] Also published in *A. Favre*, Recherches géologiques dans les parties de la Savoie, vol. i (1867), p. 310. [Lamellibranchs, pp. 367, 368, 377—390.]

—— Monographie des Couches de l'étage Valangien des Carrières d'Arzier (Vaud). (*Matér. pour la Paléont. Suisse*, ser. 4.) [Lamellibranchs, pp. 22—52 (1868).]

—— Études sur la Faune des Couches du Gault de Cosne (Nièvre). *Mém. Soc. paléont. Suisse*, vol. ix (1882). [Lamellibranchs, pp. 43—86, 89—103.]

Loriol, P. de Om fossile Saltvandsdyr fra Nord-Grönland. *Meddel. om Grönland*, vol. v, pt. iv (1883), p. 205.

—— and Gilliéron, V. Monographie paléontologique et stratigraphique de l'étage Urgonien Inférieur de Landeron, Canton de Neuchâtel. *Mém. Soc. helvét. Sci. nat.*, vol. xxiii (1869), p. 1. [Lamellibranchs, pp. 9—28.]

Lundgren, B. Palaeontologiska Iakttagelser öfver Faxekalken på Limhamn. *Lunds Univers. Årsskrift.*, 1867. [Lamellibranchs, pp. 23—31.]

- Rudister i Kritformationen i Sverige. *Acta Univ. Lund.*, vol. vi, No. 9, 1869.

- Om Inoceramusarterna i Kritformationen i Sverige. *Geol. För. i Stockholm Forhandl.*, vol. iii (1876), p. 89.

—— Anmärkningar om Spondylusarterna i Sveriges Kritsystem. *Sveriges Geol. Undersök.*, ser. C, No. 69 (1885).

- On an *Inoceramus* from Queensland. *Bihang. till k. Svenska Vet.-Ak. Handl.*, vol. xi, No. 5, 1886.

—— List of the Fossil Faunas of Sweden. III. Mesozoic. Stockholm, 1888. [Lamellibranchs, pp. 12—15.]

—— Mollusk-faunan i Mammillatus och Mucronata zonerna i nordöstra Skåne. *K. Svenska Vet.-Akad. Handl.*, N. F., vol. xxvi, No. 6, 1894. [Lamellibranchs, pp. 35—52.]

—— Note sur le système crétacé de la Suede. *Bull. Soc. géol. de France*, ser. 3, vol. x (1882), p. 456. [Lamellibranchs, pp. 457, 458.]

Lycett, J. A Monograph of the British Fossil Trigoniæ. (*Palæont. Soc.*). 1872–83.

Maas, G. Die untere Kreide des subhercynen Quadersandstein-Gebirges. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xlvii (1895), p. 227. [Lamellibranchs, pp. 256—271.] *Ibid.*, vol. li (1899), p. 243. [Lamellibranchs, pp. 248, 249.]

M'Coy, F. Note on the Cretaceous Deposits of Australia. *Ann. Mag. Nat. Hist.*, ser. 3, vol. xvi (1865), p. 333. [Lamellibranchs, p. 334.]

—— Zoology and Palæontology of Victoria. *Ibid.*, ser. 3, vol. xx (1867), p. 175. [Lamellibranchs, p. 196.]

—— On the Discovery of Cretaceous Fossils in Australia. *Trans. and Proc. Roy. Soc. Victoria*, vol. vii (1866), p. 49. [Lamellibranchs, p. 50.]

Mallada, L. Sinopsis de las Especies Fósiles que se han encontrado en España. Vol. iii. Terreno Mesozoico (Cretáceo inférior). *Bolet. Com. Mapa geol. de España*, vol. xiv (1887). [Lamellibranchs, pp. 80—141.]

Mantell, G. The Fossils of the South Downs; or, Illustrations of the Geology of Sussex. London, 1822. [Lamellibranchs, pp. 73, 74, 94—96, 126—130, 201—208, 211—220.]

Martin, K. Ueber das Vorkommen einer Rudisten fuehrenden Kreideformation im suedoestlichen Borneo. *Sammlung. geol. Reichs-Museums in Leiden*, vol. iv (1889), p. 117.

MARTIN, K. Die Fauna der Kreideformation von Martapoera. *Ibid.*, p. 126. [Lamellibranchs, pp. 151—178.]

MATHERON, P. Catalogue méthodique et descriptif des Corps organisés fossiles du Département des Bouches-du-Rhône et lieux circonvoisins. *Répertoire des travaux de la Soc. statist. de Marseille*, vol. vi. Marseille, 1842.

— Recherches paléontologiques dans le midi de la France. Marseille, 1878–80. [Cretaceous Lamellibranchs, pt. iii, pls. C i—iv, C viii—xiv, C xviii; pt. vi, pls. F xxii, xli—xliii; pt. vii, pl. G x.]

MAYER-EYMAR, C. Ueber Neocomian-Versteinerungen aus dem Somaliland. *Vierteljahrschr. d. nat. Gesellsch. Zurich*, vol. xxxviii (1893), p. 249. [Lamellibranchs, pp. 253, 254, 263.]

—— L'apparition dès le Campanien (Senonien) de *Ostrea* (*Gryphæa*) *angulata*. *Eclogae geol. Helvet.*, vol. vi (1900), p. 121.

— Sur la distribution stratigraphique de l' *Ostrea* (*Gryphæa*) *vesicularis*. *Ibid.*, vol. vi (1900), p. 121.

MAYER-EYMAR, F. Systematisches Verzeichniss der Kreide- und Tertiär-Versteinerungen der Umgegend von Thun. *Beitr. z. geol. Karte der Schweiz*, vol. xxiv (2) (1887). [Lamellibranchs, pp. 3—6.]

MEEK, F. B. Description of New Organic Remains from the Cretaceous Rocks of Vancouver's Island. *Trans. Albany Instit.*, vol. iv (1858), p. 37. [Lamellibranchs, pp. 39—44.]

—— Descriptions of new Fossil Remains collected in Nebraska and Utah by the Exploring Expeditions under the command of Capt. J. H. Simpson. *Proc. Acad. Nat. Sci. Philad.*, vol. iv (1860), p. 308. [Lamellibranchs, pp. 311, 312.]

—— Description of new Cretaceous Fossils collected by the North-Western Boundary Commission on Vancouver and Sucia Islands. *Ibid.*, ser. 2, vol. v (1861), p. 314. [Lamellibranchs, pp. 315, 316.]

—— Check List of the Invertebrate Fossils of North America. Cretaceous and Jurassic. Smithson. Miscell. Coll., 177. Washington, 1864. [Lamellibranchs, pp. 5—16, 31—34.]

— Preliminary List of the Fossils collected by Dr. Hayden's Exploring Expedition of 1871 in Utah and Wyoming Territories, with descriptions of a few New Species. *Hayden's Prelim. Rep. U. S. Geol. Surv. Montana, etc.*, 1871 (1872), p. 373. [Lamellibranchs, pp. 375, 376.]

— A Report on the Cretaceous Fossils contained in the Collections brought from New Mexico. *Rep. Explor. Exped. from Santa Fé to the Grand and Green Rivers, etc., in* 1859, under Capt. J. N. Macomb. With Geological Report by J. S. Newberry. Washington (1876), p. 121. [Lamellibranchs, pp. 123—129.]

—— A Report on the Invertebrate, Cretaceous and Tertiary Fossils of the Upper Missouri Country. *United States Geol. Surv. Territories*, vol. ix. Washington (1876). [Lamellibranchs, pp. 10—265.]

MEEK, F. B., and HAYDEN, F. V. Descriptions of twenty-eight new species of Acephala and one Gasteropod, from the Cretaceous Formations of Nebraska Territory. *Proc. Acad. Nat. Sci. Philad.*, vol. viii (1856), p. 81.

— — · — Descriptions of new Fossil Species of Mollusca collected in Nebraska, etc. *Ibid.*, p. 265. [Lamellibranchs, pp. 270—277, 283—286.]

—— —— Descriptions of new species and genera of Fossils, collected by Dr. F. V. Hayden in Nebraska Territory. . . *Ibid.*, ser. 2, vol. i, 1857 (1858), p. 117. [Lamellibranchs, pp. 142—147.]

—— —— Descriptions of new Organic Remains from the Tertiary, Cretaceous, and Jurassic Rocks of Nebraska. *Ibid.*, ser. 2, vol. iv, 1860 (1861), p. 175. [Lamellibranchs, pp. 178—182.]

— —— Synonymic Catalogue of Jurassic, Cretaceous, and Tertiary Fossils collected in Nebraska. *Ibid.*, p. 417. [Lamellibranchs, pp. 424—429.]

—— —— Descriptions of new Cretaceous Fossils from Nebraska Territory. . . . *Ibid.*, ser. 2, vol. vi, 1862 (1863), p. 21. [Lamellibranchs, pp. 26—28.]

MELI, R. Sulle Chamacèe e sulle Rudiste del Monte Affilano presso Subiaco nel circondario di Roma. *Boll. Soc. geol. Ital.*, vol. xx (1901), p. 149.

MERCEY, N. DE. Description de l'*Inoceramus Mantelli*. *Mém. Soc. Linn. Nord de la France*, vol. iv (1877), p. 324, pls. i, ii.

MICHAEL, R. Cenoman und Turon in der Gegend von Cudowa in Schlesien. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xlv (1893), p. 195. [Lamellibranchs, pp. 232—239, 241—243.]

—— Ueber Kreidefossilien von der Insel Sachalin. *Jahrb. d. k. preuss. geol. Landesanst.*, vol. xix, 1898 (1899), p. 153. [Lamellibranchs, pp. 156—164.]

MICHELIN, H. Note sur un Argile dépendant du Gault observée au Gaty, Commune de Gérodot, Département de l'Aube. *Mém. Soc. géol. de France*, vol. iii (1838), p. 97. [Lamellibranchs, pp. 102, 103.]

MOESCH, C. Monographie der Pholadomyen. *Abhandl. schweizer. paläont. Gesellsch.*, vol. i, 1874. [Cretaceous, pp. 82—115.]

MOORE, C. Australian Mesozoic Geology and Palæontology. *Quart. Journ. Geol. Soc.*, vol. xxvi (1870), p. 226. [Lamellibranchs, pp. 245—255.]

MÖRICKE, W. Die Gastropoden und Bivalven der Quiriquina-Schichten [in G. STEINMANN's Beiträge zur Geologie und Paläontologie von Südamerika, iii]. *Neues Jahrb. für Min., etc.*, Beil. Bd. x (1895), p. 1. [Lamellibranchs, pp. 100—106.]

MORRIS, J. A Catalogue of British Fossils. Second Edition. London, 1854.

MORTON, S. G. Synopsis of the Organic Remains of the Ferruginous Sand Formation of the United States; with geological remarks. *Amer. Journ. Sci. and Arts*, vol. xvii (1829), p. 274. [Lamellibranchs, pp. 283—286.] *Ibid.*, vol. xviii (1830), p. 245.

— Synopsis of the Organic Remains of the Cretaceous Group of the United States. Philadelphia, 1834. [Lamellibranchs, pp. 50—69.]

Morton, S. G. Two new species of Fossils from the Lower Cretaceous Strata of New Jersey. *Proc. Acad. Nat. Sci. Philad.*, vol. i (1841), p. 132.

— Description of some new species of Organic Remains of the Cretaceous Group of the United States, etc. *Journ. Acad. Nat. Sci. Philad.*, ser. 1, vol. viii (1842), p. 207. [Lamellibranchs, p. 214.]

Moulins, C. Des. Essai sur les Spherulites, ... et considérations sur la famille à laquelle ces fossiles appartiennent. *Bull. d'hist. nat. Soc. Linn. de Bordeaux, etc.*, vol. i, 1826.

Müller, G. Beitrag zur Kenntniss der oberen Kreide am nördlichen Harzrande. *Jahrb. d. k. preussisch. geol. Landesanst.* für 1887 (1888), p. 372. [Lamellibranchs, pp. 400—437.]

— Die Molluskenfauna des Untersenon von Braunschweig und Ilsede. I. Lamellibranchiaten und Glossophoren. *Abhandl. d. k. preussisch. geol. Landesanst.*, N. F., Heft 25. Berlin, 1898.

—— Versteinerungen des Jura und der Kreide. In W. Bornhardt 'Zur Oberflächengest. u. Geol. Deutsch-Ostafrikas.' *Deutsch-Ost-Afrika*, vol. vii (1900), p. 514, pls. xiv—xxv. [Lamellibranchs, pp. 542—546, 548—557, 561—563, 565—567.]

Müller, J. Monographie der Petrefacten der Aachener Kreideformation. Bonn. Part 1, 1847; part 2, 1851. Supplement, Aachen, 1859.

Munier-Chalmas, E. Prodrome d'une classification des Rudistes. *Journ. de Conchyl.*, ser. 3, vol. xiii (1873), p. 71.

—— Études critiques sur les Rudistes. *Bull. Soc. géol. de France*, ser. 3, vol. x (1882), p. 473.

—— Note sur les Rudistes. *Ibid.*, ser. 3, vol. xvi (1888), p. 819.

Murchison, de Verneuil, and Keyserling, see d'Orbigny.

Neumayr, M., and Holub, E. Ueber einige Fossilien aus der Uitenhage-Formation in Süd-Africa. *Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Cl.*, vol. xliv (1882), p. 267. [Lamellibranchs, pp. 275, 276.]

Newton, E. T., and Etheridge, R. A Catalogue of the Cretaceous Fossils in the Museum of Practical Geology. London, 1878. [Lamellibranchs, pp. 11—21, 28—32, 39—42, 52—60, 67, 68, 73, 74, 78, 83, 84, 97—99.]

Newton, R. B. Notes on Fossils from Madagascar, with descriptions of two New Species of Jurassic Pelecypoda from that island. [Appendix to Notes on the Geology of Madagascar by R. Baron.] *Quart. Journ. Geol. Soc.*, vol. xlv (1889), p. 331. [Cretaceous Lamellibranchs, pp. 333, 334.]

—— On the Occurrence of *Alectryonia ungulata* in S.E. Africa, with a notice of previous researches on the Cretaceous Conchology of Southern Africa. *Journ. of Conch.*, vol. viii (1896), p. 136.

—— An account of the Albian Fossils lately discovered at Okeford Fitzpaine, Dorset. *Proc. Dorset Nat. Hist. and Antiq. Field Club*, vol. xviii (1897), p. 66. [Lamellibranchs, pp. 71—74, 84—97.]

Newton, R. B. On some Cretaceous Shells from Egypt. *Geol. Mag.* (1898), p. 394. [Lamellibranchs, pp. 396—403.]

Nikitin, S. Les Vestiges de la Periode crétacé dans la Russie centrale. *Mém. du Comité géol. Russ.*, vol. v, No. 2 (1888). [Lamellibranchs, pp. 72—74.]

Nilsson, S. Petrificata Suecana Formationis Cretaceæ, descripta et iconibus illustrata. Lund, 1827.

Nötling, F. Die Fauna der baltischen Cenoman-Geschiebe. *Palæont. Abhandl.*, vol. ii, Heft 4. Berlin, 1885. [Lamellibranchs, pp. 14—36.]

—— Entwurf einer Gliederung der Kreideformation in Syrien und Palästina. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxxviii (1886), p. 824. [Lamellibranchs, pp. 856—871.]

—— Fauna of Báluchistan. Vol. i, pt. 2. The Fauna of the (Neocomian) *Belemnites* Beds. *Palæont. Indica*, 1897. [Lamellibranchs, pp. 1, 2.]

—— *Ibid.*, pt. 3. Fauna of the Upper Cretaceous (Mäestrichtien) Beds of the Mari Hills. *Ibid.*, 1897. [Lamellibranchs, pp. 37—53.]

Nyst, H. P. Tableau synoptique et synonymique des espèces vivantes et fossiles de la Famille des Arcacées, etc. *Mém. Acad. Roy. Belg.*, vol. xxii, 1848.

Ooster, W. A. Beitrag zur Kenntniss der Fauna der obersten Kreideschicht am Nord-ufer des Thuner-See's (Berner-Alpen). *Protozoe Helvetica*, vol. ii (1870), p. 43. [Lamellibranchs, pp. 55—57.]

—— Die organischen Rester der Pteropodenschicht einer Unterlage der Kreideformation in den Schweizer-Alpen. *Ibid.*, vol. ii (1871), p. 89. [Lamellibranchs, pp. 100—106, 121—127, 140, 141, 144.]

Oppenheim, P. Ueber einige Brackwasser- und Binnen-Mollusken aus der Kreide und dem Eocän Ungarns. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xliv (1892), p. 697. [Lamellibranchs, p. 800.]

—— Beiträge zur Binnenfauna der provençalischen Kreide. *Palæontographica*, vol. xlii (1895), p. 308. [Lamellibranchs, pp. 363—373.]

—— Ueber ein überraschendes Auftreten von *Exogyra columba*, Lk., bei Crespano Veneto. *Centralbl. für Min., etc.* (1902), p. 500.

—— Ueber die Fossilien der Blättermergel von Theben. *Sitzung. d. k. bayer. Akad. Wissensch., Math.-phys. Cl.*, vol. xxxii (1903), p. 435. [Lamellibranchs, pp. 439—442.]

Orbigny, A. d'. Quelques considérations zoologiques et géologiques sur les Rudistes. *Ann. Sci. nat.*, ser. 2, vol. xvii (Zool.) (1842), p. 173.

—— Voyage dans l'Amérique Méridional. Vol. iii, pt. iv. Paléontologie. Paris, 1842. [Lamellibranchs, pp. 81—94.]

—— In X. Hommaire de Hell, Les Steppes de la Mer Caspienne. Paléontologie, par d'Orbigny, vol. iii (1844), p. 417. [Lamellibranchs, pp. 437—442, and Atlas.]

Orbigny, A. d'. Paléontologie Française. Description des Mollusques et Rayonnés Fossiles. Terrains Crétacés. Vol. iii, Lamellibranches. Paris, 1844–7. Pp. 1—288, 1844; 289—448, 1845; 449—520, 1846; 521—807, 1847.

—— In Murchison, R. I., Verneuil, E. de, and Keyserling, A. de. Géologie de la Russie de l'Europe, etc. Vol. ii, Paléontologie. London and Paris (1845). [Lamellibranchs, by d'Orbigny, pp. 490—492.]

— Voyage au Pole Sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée. Atlas Géol. (1847). [Cretaceous Lamellibranchs, pls. v, vii, viii.] (Geol. Minér. et Geogr. Phys. du Voyage par J. Grange, Paris, 1854.)

Note sur les fossiles de l'étage danien. *Bull. Soc. géol. de France*, ser. 2, vol. vii (1850), p. 126. [Lamellibranchs, pp. 130—132.]

— Prodrome de Paléontologie stratigraphique universelle, etc. Paris. Vol. ii (1850), pp. 72—84, 117—120, 135—139, 157—171, 194—198, 233—257.

Owen, D. D. Second Report of a Geological Reconnaisance of the Middle and Southern Counties of Arkansas during 1859 and 1860. Philadelphia, 1860. [Lamellibranchs, pls. vii, viii.]

Pálfy, M. v. Die oberen Kreideschichten in der Umgebung von Alvincz. *Mittheil. a. d. Jahrb. d. k. ungarisch. geol. Anst.*, vol. xiii (1902), p. 243. [Lamellibranchs, pp. 271—300.]

Pâquier, V. Sur quelques Rudistes nouveaux de l'Urgonien. *Comptes Rendus Acad. Sci. Paris*, vol. cxxii (1896), p. 1223.

—— Sur la présence de Caprininés dans l'Urgonien. *Ibid.* (1896), p. 1434.

—— Sur quelques Rudistes nouveaux de l'Urgonien. *Bull. Soc. Statist. Isère*, ser. 4, vol. iv (1899), p. 93.

—— Sur la présence de Caprininés dans l'Urgonien. *Ibid.* (1899), p. 97.

— Sur la présence du genre *Caprina* dans l'Urgonien. *Comptes Rendus Acad. Sci. Paris*, vol. cxxxii (1901), p. 229.

—— Sur la Faune et l'âge des Calcaires à Rudistes de la Dobrogea. *Bull. Soc. géol. de France*, ser. 4, vol. i (1901), p. 473.

—— Sur les relations du Groupe Inverse avec le Groupe normale chez les Chamacées. *Ibid.* (1901), p. 474.

Parkinson, J. Organic Remains of a Former World. An Examination of the mineralised remains of Vegetables and Animals of the Antediluvian World generally termed Extraneous Fossils. 3 vols. London, 1804, 1808, 1811. [Lamellibranchs, vol. iii (1811), pp. 165—226.]

Parona, C. F. Sopra alcune Rudiste Senoniane dell' Appennino meridionale. *Mem. R. Accad. Sci. Torino*, ser. 2, vol. l (1901), p. 1.

—— Le Rudiste e le Camacee di S. Polo Matese. *Ibid.* (1901), p. 197.

— and Bonarelli, G. Fossili Albiani d'Escragnolles, del Nizzardo e della Liguria Occidentale. *Palæont. Ital.*, vol. ii (1897), p. 53. [Lamellibranchs, p. 67.]

Passy, A. Description géologique du Département de la Seine-Inférieure. Rouen, 1832.

Pavlow, A. P. On the Classification of the Strata between the Kimeridgian and the Aptian. *Quart. Journ. Geol. Soc.*, vol. lii (1896), p. 542. [Lamellibranchs, pp. 549, 550.]

Penning and Jukes-Browne, see R. Etheridge.

Peron, A. Observations sur la Faune des Calcaires à Echinides de Rennes-les-Bains et sur quelques Fossiles du terrain crétacé supérieur. *Bull. Soc. géol. de France*, ser. 3, vol. v (1877), p. 499. [Lamellibranchs, pp. 501—516, 518—520.]

—— Notes pour servir à l'histoire du Terrain de Craie dans le sud-est du Bassin Anglo-Parisien. *Bull. Soc. Sci. hist. et nat. de l'Yonne*, ser. 3, vol. xii (Année 1887, vol. 41), pp. 145—224, August, 1887; pp. 225—366, March, 1888. [Lamellibranchs, pp. 288—324 (1888).]

—— Description des Mollusques Fossiles des Terrains Crétacés de la Région Sud des Hauts—Plateaux de la Tunisie, part 2. Paris, 1890–1. (Exploration Scientifique de la Tunisie.) [Lamellibranchs, pp. 105—327, pls. xxiii—xxix.]

Pethő, J. Ueber das vorkommen von *Hippurites* (*Pironæa*) *polystylus* in den Hypersenonenschichten zu Cserevitz im Pétervárader Gebirge. *Foldt. Közlony*, vol. xxxiii (1903), pp. 17, 134.

Petraschecк, W. Ueber Inoceramen aus der Kreide Böhmens und Sachsens. *Jahrb. d. k. k. geol. Reichsanst.*, vol. liii (1903), p. 153.

Philippi, E. Beiträge zur Morphologie und Phylogenie der Lamellibranchier. I. Ueber *Hinnites* und *Velopecten*. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. l (1898), p. 597. II. Zur Stammesgeschichte der Pectiniden. *Ibid.*, vol. lii (1900), p. 64. III. *Lima* und ihre Untergattungen. *Ibid.*, vol. lii (1900), p. 619.

Philippi, R. A. Los Fósiles Secondarios de Chile: Santiago de Chile. Santiago de Chile, 1899. [Some Cretaceous Lamellibranchs.]

Phillips, J. Illustrations of the Geology of Yorkshire; or a description of the strata and organic remains of the Yorkshire Coast. York, 1829. [Lamellibranchs, pp. 119, 121, 122, 169—172, 186.] Third edition. Edited by R. Etheridge. Part I. The Yorkshire Coast. London, 1875. [Lamellibranchs, pp. 244—256.]

—— Geology of Oxford and the Valley of the Thames. Oxford, 1871. [Lamellibranchs, pp. 437—439, pl. xvii.]

Pictet, F. J. Mélanges Paléontologiques. Vol. i. Bâle et Geneva (1863–68). [Lamellibranchs, pp. 255—263 (1868).]

—— and Campiche, G. Description des Fossiles du Terrain Crétacé des Environs de Sainte-Croix, part iii. (*Matér. pour la Paléont. Suisse*, ser. 4.) 1864–67.

—— —— *Ibid.*, part iv. (*Ibid.*, ser. 5.) 1868–71.

Pictet, F. J , and de Loriol, P. Description des Fossiles contenus dans le Terrain Néocomien des Voirons. (*Ibid.*, ser. 2.) [Lamellibranchs, pp. 41—44 (1858).]

— and Renevier, E. Description des Fossiles du Terrain Aptien de la Perte du Rhone et des Environs de Ste. Croix. (*Ibid.*, ser. 1.) [Lamellibranchs, pp. 54—142 (1855–8).]

—— and Roux, W. Description des Mollusques Fossiles qui se trouvent dans les Grès Verts des Environs de Genève. Genève, 1847–53. [Lamellibranchs, pp. 389—527, 550, 551 (1852–3).]

Pirona, G. A. Sopra una particolare modificazione dell' Apparato cardinale in un Ippurite. *Mem. d. Real Istituto Veneto di Scienze, etc.*, vol. xxi (1880), p. 419.

—— Nuovi Fossili del Terreno cretaceo del Friuli. *Ibid.*, vol. xxii (1882), p. 159. [Lamellibranchs, pp. 166, 167.]

—— Due Chamacee Nuove del Terreno cretaceo del Friuli. *Ibid.*, vol. xxii (1884), p. 689.

Placketko, S. Das Becken von Lemberg. Ein Beitrag zur Geognosie und Palaeontologie Ostgaliziens. *Jahres-bericht d. k. k. zweit. Ober Gymnas. in Lemberg*, 1863. [Lamellibranchs, pp. 17—23, 26.]

Platnauer, H. M. List of figured specimens in the York Museum. *Ann. Rep. Yorks. Phil. Soc. for* 1890 (1891), p. 56. [Lamellibranchs, pp. 64—70.]

Počta, P. Vorläufiger Bericht über die Rudisten der böhmischen Kreideformation. *Sitzung. d. k. böhm. Gesellsch. d. Wissensch.*, 1886 (1887), p. 194. [Lamellibranchs, pp. 198—207.]

Pompeckj, J. F. Ueber Aucellen und Aucellen-ähnliche Formen. *Neues Jahrb. für Min., etc.*, Beilage-Band xiv (1901), p. 319.

Popovice-Hatzeg, V. Contribution à l'étude de la Faune du Crétacé supérieur de Roumanie. Environs de Campulung et de Sinaia. *Mém. Soc. géol. de France. Paléontologie*, vol. viii, pt. 3. [Lamellibranchs, pp. 7, 8.]

Potiez, V. L. V., and Michaud, A. L. G. Galerie des Mollusques ou catalogue méthodique, descriptif et raisonné des Mollusques et Coquilles de Douai. 2 vols. Paris, 1838, 1844. [Lamellibranchs, vol. ii, pp. 33—273.]

Price, F. G. H. On the Gault of Folkestone. *Quart. Journ. Geol. Soc.*, vol. xxx (1874), p. 342. [Lamellibranch, p. 358.]

Pusch, G. G. Polens Paläontologie, etc. Stuttgart, 1837. [Lamellibranchs, pp. 29—92.]

Quaas, A. Beitrag zur Kenntniss der Fauna der obersten Kreidebildungen in der libyschen Wüste. II. Die Fauna der Overwegischichten und der Blätterthone in der libyschen Wüste. *Palæontographica*, vol. xxx, pt. 2 (1902), p. 153. [Lamellibranchs, pp. 167—233.]

Raun, J. P. J. Molluskerne i Danmarks Kridtaflejringer. I. Lamellibranchiater. *K. Danske Vidensk. Selsk. Skrifter*, 6 *Række, naturvidensk. og math. Afd.*, vol. xi (1902), pp. 73—138, pls. i—iv.

Redlich, K. A. Ueber Kreideversteinerungen aus der Umgebung von Görz und Pinguente. *Jahrb. d. k. k. geol. Reichsanst.*, vol. li (1901), p. 75. [Lamellibranchs, pp. 75—85.]

Rehbinder, B. Fauna und Alter der Cretaceischen Sandsteine in der Umgebung des Salzsees Baskuntschak. *Mém. du Comité géol. Russ.*, vol. xvii, No. 1 (1902). [Lamellibranchs, pp. 73—79, 156—162.]

Reis, O. M. Die Fauna der Hachauer Schichten. II. Lamellibranchiaten. *Geognost. Jahresh.*, München, 1897 (1898), pp. 94—128.

Reuss, A. E. Geognostische Skizzen aus Böhmen. 2 vols. Vol. i, Prag, etc. (1840). Vol. ii, Prag (1844), pp. 177—201.

—— Die Versteinerungen der böhmischen Kreideformation. Stuttgart. Part i, 1845; part ii, 1846. [Lamellibranchs, pt. ii, pp. 1—45.]

—— Ueber zwei neue Rudisten-species aus den Alpinen Kreideschichten der Gosau. *Sitzung. d. k. Akad. Wissensch. Wien*, vol. xi (1853), p. 923.

—— Beiträge zur Charakteristik der Kreideschichten in den Ostalpen besonders im Gosauthale und am Wolfgangsee. *Denkschr. d. k. Akad. Wissensch. Wien, Math.-nat. Cl.*, vol. vii (1854), p. 1. [Lamellibranchs, pp. 145—148.]

Römer, F. Die Kreidebildungen von Texas und ihre organischen Einschlüsse. Bonn, 1852. [Lamellibranchs, pp. 44—81.]

– Geologie von Oberschlesien. Breslau, 1870. [Lamellibranchs, pp. 315—317, 332—334, 339—341, 342—344, 353, 356.]

– Ueber eine durch die Häufigkeit Hippuriten-Artigen Chamiden ausgezeichnete Fauna der Oberturonen Kreide von Texas. *Palæont. Abhandl.*, vol. iv, pt. 4 (1888). [Lamellibranchs, pp. 9—14.]

Römer, F. A. Die Versteinerungen des norddeutschen Oolithen-Gebirges. Hannover. (Pp. 1—74, 1835; 75—154, 1836; 135—218, 1836.) Ein Nachtrag, 1839. [Contain descriptions of a few Lower Cretaceous Lamellibranchs.]

—— Die Versteinerungen des norddeutschen Kreidegebirges. Hannover. (Pp. 1—48, 1840; 49—146, 1841.) [Lamellibranchs, pp. 45—76.]

—— Einige neue Versteinerungen aus dem Korallenkalk und Hilsthon. *Palæontographica*, vol. i (1851), p. 329.

—— Die Quadraten Kreide des Sudmerberges bei Goslar. *Palæontographica*, vol. xiii (1865), p. 193. [Lamellibranchs, pp. 196, 197.]

Rolland du Roquan, O. Description des Coquilles fossiles de la famille des Rudistes dans le terrain Crétacé des Corbiéres. Carcassonne, 1841.

Rutot, A. Première note sur la faune des couches Sénoniennes inférieures de la Méhaigne. *Bull. Soc. Belg. de géol. pal. et hydrol.*, vol. x (1897), p. 1. [Lamellibranchs, pp. 23—37.]

Ryckholt, P. de. Mélanges Paléontologiques. Part i (*Mém. cour. et Mém. des sav. étrang.*, vol. xxiv, 1850), pp. 99—165. Part ii (*ibid.*, 1851), pp. 23—169, 178—184.

Sumann, L. Observations sur quelques coquilles de la famille des Rudistes. *Bull. Soc. géol. de France*, ser. 2, vol. vi (1849), p. 280.

Salter, J. W. On the Cretaceous Fossils of Aberdeenshire. *Quart. Journ. Geol. Soc.*, vol. xiii (1857), p. 83.

Schlotheim, E. T. v. Beiträge zur Naturgeschichte der Versteinerungen in geognostischen Hinsicht. *Leonhard's Taschenb. für Min.*, vol. vii (1813), pp. 112, 113.

—— Die Petrefactenkunde, etc. Gotha, 1820. [Lamellibranchs, pp. 175—245.] Nachträge, 1823.

Schlüter, C. Bericht über eine geognostisch-paläontologische Reise in südlichen Schweden. *Neues Jahrb. für Min., etc.* (1870), p. 936. [Lamellibranchs, 936—938, 950—952.]

—— Zur Gattung *Inoceramus*. *Palæontographica*, vol. xxiv, 1877.

Schmidt, F. Wissenschaftliche Resultate der zur Aufsuchung eines angehündigten Mammuthcadavers von d. k. Akademie an den unteren Jenissei ausgesandten Expedition. *Mém. de l'Acad. Imp. des Sci. de St. Petersb.*, ser. vii, vol. xviii, No. 1 (1872). [Lamellibranchs, pp. 146—162.]

—— Ueber die Petrefakten der Kreideformation von der Insel Sachalin. *Ibid.*, ser. vii, vol. xix, No. 3 (1873). [Lamellibranchs, pp. 22—32.]

Schnarrenberger, C. Ueber die Kreideformation der Monte d'Ocre-Kette in den Aquitaner Abruzzen. *Berichte d. nat. Gesellsch. Freiburg I.B.*, vol. xi (1901), p. 176. [Lamellibranchs, pp. 194—202.]

Schröder, H. Ueber senone Kreidegeschiebe der Provinzen Ost- und Westpreussen. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xxxiv (1882), p. 243. [Lamellibranchs, pp. 259—275.]

Schubert, R. J. Ueber einige Bivalven des istrodalmatischen Rudistenkalkes. *Jahrb. d. k. k. geol. Reichsanst.*, vol. lii (1903), p. 265.

Seeley, H. G. Notes on Cambridge Palæontology. I. Some new Upper Greensand Bivalves. *Ann. Mag. Nat. Hist.*, ser. 3, vol. vii (1861), p. 116, pls. v, vi.

—— *Mytilus spathulatus*, a new Cretaceous species. *Geologist*, vol. vii (1864), p. 53.

Seguenza, G. Studî geologici e paleontologici sul cretaceo medio dell' Italia meridionale. *Atti d. R. Accad. dei Lincei* (ser. 3). *Mem. d. Cl. di Scien. Fis. Math. nat. Roma*, vol. xii (1882), p. 65. [Lamellibranchs, pp. 123—184.]

Shaler, N. S. On the Occurrence of Fossils of the Cretaceous Age on the Island of Martha's Vineyard, Mass. *Bull. Mus. Comp. Zool. Harvard*, vol. xvi (1889), p. 89. [Lamellibranchs on pl. ii.]

Sharpe, D. On the Age of the Fossiliferous Sands and Gravels of Faringdon and its Neighbourhood. *Quart. Journ. Geol. Soc.*, vol. x (1853), p. 176. [Lamellibranchs, pp. 197, 198.]

Sharpe, D. Description of Fossils from the Secondary Rocks of Sunday River and Zwartkop River, South Africa, collected by Dr. Atherstone and A. G. Bain, Esq. *Trans. Geol. Soc.*, ser. 2, vol. vii (1856), p. 193. [Lamellibranchs, pp. 193—196, 198, 199.]

Shumard, B. F. Descriptions of New Cretaceous Fossils from Texas. *Trans. Acad. Sci. St. Louis*, vol. i (1860), p. 590. [Lamellibranchs, pp. 598—609.]

—— Descriptions of New Cretaceous Fossils from Texas. *Proc. Boston Soc. Nat. Hist.*, vol. viii (1861), p. 188. [Lamellibranchs, pp. 199—205.]

Simionescu, J. Ueber die obercretacische Fauna von Ürmos (Siebenbürgen). *Verhandl. d. k. k. geol. Reichsanst.* (1899), p. 227. [Lamellibranchs, pp. 229—231.]

—— La Faune Néocomienne du Bassin de Dimbovicioara. *Ann. Scient. Univ. Jassy*, vol. i (1900), p. 187. [Lamellibranchs, pp. 199, 200.]

Skeat, E. G., and Madsen, V. On Jurassic, Neocomian, and Gault Boulders found in Denmark. *Danmarks geol. Undersogelse.*, vol. ii, No. 8 (1898), pp. 160—191.

Söhle, U. Geologische Aufnahme des Labergebirges bei Oberammergau, etc. *Geogn. Jahreshefte* (1896), 1897. [Lamellibranchs, pp. 31—41.]

Sowerby, J., and Sowerby, J. de C. The Mineral Conchology of Great Britain; or coloured figures and descriptions of those remains of testaceous animals or shells which have been preserved at various times and depths in the earth. 7 vols. London, 1812—1846.

Sowerby, J. de C. In Fitton, W. H. Observations on some of the Strata between the Chalk and the Oxford Oolite in the South-east of England. *Trans. Geol. Soc.*, ser. 2, vol. iv (1836), p. 103. [Lamellibranchs, pp. 335—342, 353—361.]

—— In Dixon, F. The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex London, 1850.[1] [Lamellibranchs, pp. 346—348, 354—357.] Second Edition, 1878. [Lamellibranchs, pp. 382, 383, 385, 386.]

Stanton, T. W. The Colorado Formation and its Invertebrate Fauna. *Bull. U. S. Geol. Survey*, No. 106 (1893). [Lamellibranchs, pp. 54—127, pls. i—xxvii.]

—— Contributions to the Cretaceous Palæontology of the Pacific Coast. The Fauna of the Knoxville Beds. *Ibid.*, No. 133 (1895). [Lamellibranchs, pp. 34—62, pls. ii—xii.]

—— On the Genus *Remondia*, a group of Cretaceous Bivalve Mollusks. *Proc. U. S. National Mus.*, vol. xix (1897), p. 299, pl. xxvi.

—— Geology of the Yellowstone National Park (by Hague, Iddings, etc.). *Mon. U. S. Geol. Survey*, vol. xxxii, pt. 2 (1899). [Cretaceous Lamellibranchs, pp. 633—639.]

[1] The date on the title-page is 1850. Morris gives the date of publication as 1852, and Mr. Sherborn believes that the work was not issued before that year.

STANTON, T. W. Reports of the Princeton University Expeditions to Patagonia, 1896—1899. Vol. IV, Palæontology; part i, The Marine Cretaceous Invertebrates, 1901. [Lamellibranchs, pp. 11—28.]

—— *Chondrodonta*, a new genus of Ostreiform Mollusks from the Cretaceous, with descriptions of the genotype and a new species. *Proc. U.S. National Mus.*, vol. xxiv (1902), p. 301.

STATHER, J. W. *Teredo amphisbæna* at South Ferriby. *Trans. Hull Geol. Soc.*, vol. v (1902), p. 41.

STEFANI, C. DE. Studî paleozoologici sulla creta superiore e media dell' Apennino settentrionale. *Atti d. R. Accad. dei Lincei* (Roma), ser. 4, vol. i (1884—5), p. 73. [Lamellibranchs, pp. 103—107.]

STEFANO, G. DI. Studj Stratigrafici e Paleontologici sul Sistema Cretaceo della Sicilia. I. Gli Strati con *Caprotina* di Termini-Imerese. *Atti d. R. Accad. di Sci., Lett., e Belle Arti di Palermo*, n. s., vol. x (1889). [Lamellibranchs, pp. 1—44.]

—— Studi Stratigraphica e Paleontologia sul Sistema Cretaceo della Sicilia. *Palæontographia Italica*, vol. iv (1898), p. 1. [Lamellibranchs, pp. 23—46.]

STEINMANN, G. Ueber Tithon und Kreide in den peruanischen Anden. *Neues Jahrb. für Min., etc.* (1881), vol. ii, pp. 144—149. *Ibid.* (1882), vol. i, p. 166.

—— Die Gruppe der *Trigoniæ pseudo-quadratæ*. *Ibid.* (1882), vol. i, p. 219.

—— see MÖRICKE.

STOLICZKA, F. Cretaceous Fauna of Southern India. Vol. III, The Pelecypoda. *Palæontologia Indica*, 1870–71.

STOLLEY, E. Die Kreide Schleswig-Holsteins. *Mittheil. a. d. Mineralog. Instit. d. Universit. Kiel*, vol. i (1892), p. 191. [Lamellibranchs, pp. 235—244.]

STROMBECK, A. VON. Ueber die Kreide am Zeltberg bei Lüneburg. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xv (1863), p. 97. [Lamellibranchs, pp. 104—110, 119—123, 124—127, 143—157.]

STUR, D. Bericht über die geologische Uebersichtsaufnahme des südwestlichen Siebenbürgen im Sommer 1860. *Jahrb. d. k. k. geol. Reichsanst.*, vol. xiii (1863), p. 33. [Lamellibranchs, pp. 54—56.]

STURM, F. Der Sandstein von Kieslingswalde in der Grafschaft Glatz und seine Fauna. *Jahrb. d. k. preussisch. geol. Landesanst.* für 1900, vol. xxi (1901), pt. 3, p. 39. [Lamellibranchs, pp. 73—96.]

TATE, R. On the Correlation of the Cretaceous Formations of the North-east of Ireland. *Quart. Journ. Geol. Soc.*, vol. xxi (1865), p. 15. [Lamellibranchs, pp. 39—41.]

—— On some Secondary Fossils from South Africa. *Ibid.*, vol. xxiii (1867), p. 139. [Lamellibranchs, pp. 154—162.]

—— On Two New Cretaceous Bivalves. *Trans. Roy. Soc. S. Australia*, vol. xxii (1898), p. 77.

Tausch, L. Ueber die Fauna der nicht marinen Ablagerungen der oberen Kreide des Csingerthales bei Ajka im Bakony (Verszprimer Comitat, Ungarn), und ueber einige Conchylien der Gosaumergel von Aigen bei Salzberg. *Abhandl. d. k. k. geol. Reichsanst. Wien*, vol. xii (1886), p. 1. [Lamellibranchs, pp. 24—26.]

Tenison-Woods, J. E. On some Mesozoic Fossils from Central Australia. *Proc. Linn. Soc. N. S. Wales*, vol. viii, 1883 (1884), p. 235 (? Cretaceous). [Lamellibranchs, pp. 237—241.]

Terquem, O. Observations sur les études critiques des Mollusques fossiles comprenant la Monographie des Myaires de M. Agassiz. *Mém. de l'Acad. impér. de Metz*, Année 1854–55 (1855), p. 253, pls. i—v.

Tiessen, E. Die subhercyne Tourtia und ihre Brachiopoden- und Mollusken-Fauna. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xlvii (1895), p. 423. [Lamellibranchs, pp. 462—487.]

Toucas, A. Note sur le Sénonien, et en particulier sur l'Âge des Couches à Hippurites. *Bull. Soc. géol. de France*, ser. 3, vol. xix (1891), p. 506. [Lamellibranchs (*Hippurites*), pp. 527—552.]

—— Sur l'évolution des Hippurites. *Ibid.*, ser. 4, vol. i (1901), p. 154.

—— Sur l'origine et la classification des Hipparites. *Ibid.*, vol. ii (1902), p. 337.

Toula, F. Beschreibung mesozoischer Versteinerungen von der Kuhn-Insel. *Die zweite deutsche Nordpolf. in* 1869 *u.* 1870, vol. ii (1874), p. 497. [Lamellibranchs, pp. 502—505.]

—— Neuer Inoceramenfund im Wienersandstein des Leopoldsberges bei Wien. *Verhandl. d. k. k. geol. Reichsanst.* (1886), No. 6, p. 127.

Trabucco, G. Fossili, Stratigrafia ed Età della Creta Superiore del Bacino di Firenze. *Boll. Soc. geol. Ital.*, vol. xx (1901), p. 270. [Lamellibranchs, pp. 289—292.]

Trautschold, H. Ueber die Kreide-Ablagerungen im Gouvernement Moskau. *Bull. Soc. Imp. Nat. de Moscou*, vol. xxxiv (1861), p. 432. [Lamellibranchs on pl. xii.]

Tuomey, M. Description of some New Fossils from the Cretaceous Rocks of the Southern States. *Proc. Acad. Nat. Sci. Philad.*, vol. vii (1854), p. 167. [Lamellibranchs, pp. 170—172.]

Vacek, M. Ueber Vorarlberger Kreide. *Jahrb. d. k. k. geol. Reichsanst.*, vol. xxix (1879), p. 659. [Lamellibranchs, pp. 742—744, 746, 750—752, 753.]

Vilanova y Piera, J. Memoria geognóstico-agricólo sobre la Provincia de Castellon. *Mem. de la Real Acad. de Ciencias*, vol. iv (1859), p. 1. [Lamellibranchs, pls. ii and iii.]

Virgilio, F. *L'Ostrea Joannæ* Choffat in Provincia di Bari (Puglie). *Boll. Soc. geol. Ital.*, vol. xx (1901), p. xxxi.

Vogel, F. Das Ober-Senon von Irnich am Nordrand der Eifel. *Verhandl. nat. Vereins d. preussisch. Rheinl.*, vol. xlix (1892), p. 1. [Lamellibranchs, pp. 51—87.]

Vogel, F. Beiträge zur Kenntniss der holländischen Kreide. I. Lamellibranchiaten aus der Oberen Mucronatenkreide von holländisch. Limburg. II. Die Fossilien des Neocomsandsteins von Losser und Gildehaus. Leiden and Berlin, 1895.

Waagen, L. Der Formenkreis des *Oxytoma inaequivalve*, Sowerby. *Jahrb. d. k. k. geol. Reichsanst.*, vol. li (1901), p. 1.

Wahlenberg, G. Petrificata Telluris Suecanae. *N. Acta R. S. Scient. Upsal.*, vol. viii, Stockholm, 1821. [Lamellibranchs, pp. 56—59.]

Walker, J. F. On a Phosphatic Deposit in the Lower Greensand of Bedfordshire. *Ann. Mag. Nat. Hist.*, ser. 3, vol. xviii (1866), p. 381. [Lamellibranchs, p. 386.]

Wanner, J. Die Fauna der obersten weissen Kreide der libyschen Wüste. *Palæontographica*, vol. xxx, pt. 3 (1902), p. 91. [Lamellibranchs, pp. 114—123.]

Weerth, O. Die Fauna des Neocomsandsteins im Teutoburger Walde. *Palæont. Abhandl.*, vol. ii, Heft 1, Berlin, 1884. [Lamellibranchs, pp. 34—59.]

Weller, S. The Stokes Collection of Antarctic Fossils. *Journ. Geol.*, vol. xi (1903), p. 413. [Lamellibranch, p. 415.]

White, C. A. Descriptions of New Cretaceous Invertebrate Fossils from Kansas and Texas. *Proc. U. S. National Mus.*, vol. ii (1880), p. 292. [Lamellibranchs, pp. 293—298.]

—— Contributions to Invertebrate Palæontology, No. 2. Cretaceous Fossils of the Western States and Territories. *Twelfth Ann. Rep. U.S. Geol. and Geogr. Surv. of the Territories for* 1878. Part I (1883), p. 5. [Lamellibranchs, pp. 9—23.]

—— A Review of the Non-marine Fossil Mollusca of North America. *Third Ann. Rep. U. S. Geol. Surv.*, 1881–2 (Washington, 1883), p. 403. [Lamellibranchs, pp. 420—443.]

—— A Review of the Fossil Ostreidæ of North America, and a comparison of the fossil with living forms. *Fourth Ann. Rep. U. S. Geol. Survey*, 1882–3 (Washington, 1884), p. 273. [Cretaceous, pp. 290—308.]

—— On Mesozoic Fossils. Description of certain aberrant forms of the Chamidæ from the Cretaceous Rocks of Texas, p. 5. Mesozoic Fossils collected in Alaska, p. 10 [*Aucella*, p. 13; *Cyprina*, p. 14]. *Bull. U. S. Geol. Survey*, No. 4, 1884.

—— On New Cretaceous Fossils from California. *Ibid.*, No. 22, 1885. [Lamellibranchs, pp. 9—12.]

—— On the Mesozoic and Cenozoic Paleontology of California. *Ibid.*, No. 15 (1885). [Lamellibranchs, p. 29.]

—— On New Generic Forms of Cretaceous Mollusca and their Relation to other Forms. *Proc. Acad. Nat. Sci. Philad.* (1887), pp. 32—37.

White, C. A. Contributions to the Palæontology of Brazil, comprising descriptions of Cretaceous Invertebrate Fossils from Sergipe, Pernambuco, Para, and Bahia, 1888. (Also published in *Archiv. Mus. Nacional do Rio de Janeiro*, vol. vii, 1887.) [Lamellibranchs, pp. 26—113.]

—— *Aucella*, with special reference to its occurrence in California. *Mon. U. S. Geol. Surv.*, vol. xiii (1888), pp. 226—233, pls. iii, iv.

—— On Invertebrate Fossils from the Pacific Coast. *Bull. U. S. Geol. Survey*, No. 51, 1889. [Lamellibranchs, pp. 36—44.]

—— Notes on the Invertebrate Fauna of the Dakota Formation, with descriptions of new Molluscan forms. *Proc. U. S. National Mus.*, vol. xvii (1895), p. 131, pl. viii.

Whiteaves, J. F. Notes on the Cretaceous Fossils collected by Mr. James Richardson at Vancouver and the adjacent Islands. *Geol. Surv. Canada: Report of Progress*, 1873–74 (1874), p. 260. [Lamellibranchs, pp. 261, 262, 263, 264, 265—268.]

—— Mesozoic Fossils. Vol. I, Part I. Invertebrates from the Coal-bearing Rocks of the Queen Charlotte Islands. (*Geol. Survey of Canada*, 1876.) [Lamellibranchs, pp. 54—83.]

—— *Ibid.* Part II. On the Fossils of the Cretaceous Rocks of Vancouver and adjacent Islands in the Strait Georgia (1879). [Lamellibranchs, pp. 135—177.]

—— *Ibid.* Part III. On the Fossils of the Coal-bearing Deposits of the Queen Charlotte Islands (1884). [Lamellibranchs, pp. 193, 218—245, 250, 251.]

—— *Ibid.* Part IV, On some additional or imperfectly understood Fossils from the Cretaceous Rocks of the Queen Charlotte Islands, with a revised list of the species from these rocks (1900). [Lamellibranchs, pp. 288—301.]

—— *Ibid.* Part V. On some additional Fossils from the Vancouver Cretaceous (1903). [Lamellibranchs, pp. 372—402.]

—— Contributions to Canadian Palæontology. Vol. I, Part I. Report on the Invertebrata of the Laramie and Cretaceous Rocks of the vicinity of the Bow and Belly Rivers and adjacent localities in the North-west Territory. (*Geol. and Nat. Hist. Survey Canada*, 1885.) [Lamellibranchs, pp. 3—13, 26, 27, 30—45, 56—62, 64—69, 78—80, 83—85.]

—— *Ibid.* Vol. I, Part II. On some Cretaceous Fossils from British Columbia, the North-west Territory and Manitoba (1889), p. 151. [Lamellibranchs, pp. 151—155, 160, 165—170, 174—180, 186—189.]

—— Notes on some of the Cretaceous Fossils collected during Captain Palliser's Explorations in British North America in 1857–60. *Trans. Roy. Soc. Canada*, ser. 2, vol. i, sect. iv (1895), p. 101. [Lamellibranchs, pp. 103—108, 110—115.]

—— On some Fossils from the Nanaimo group of the Vancouver Cretaceous. *Ibid.* (1895), p. 119. [Lamellibranchs, pp. 120—126.]

Whiteaves, J. F. Description of a new species of *Unio* from the Cretaceous Rocks of the Nanaimo Coal Field. *Ottawa Naturalist*, vol. xiv (1901), p. 177.

—— Description of a Fossil *Cyrena* from Alberta. *Ottawa Naturalist*, vol. xvi (1903), p. 231.

Whitfield, R. P. Brachiopoda and Lamellibranchiata of the Raritan Clay and Greensand Marls of New Jersey. *Mon. U. S. Geol. Survey*, vol. ix (1885). [Lamellibranchs, pp. 19—221.]

—— Descriptions of Species of Rudistæ from the Cretaceous Rocks of Jamaica. *Bull. Amer. Mus. Nat. Hist.*, vol. ix (1897), p. 185, pls. vi—xxii.

—— Description of a new *Teredo*-like Shell from the Laramie Group. *Ibid.*, vol. xvi (1902), p. 73.

Wilson, E. Fossil Types in the Bristol Museum. *Geol. Mag.* (1890), pp. 371, 372, 411, 412, 414.

Wiltshire, T. On the Red Chalk of England. (Printed for the Geologists' Association. London, 1859.) [Lamellibranchs on plates i and ii.]

Windmöller, R. Die Entwickelung des Pläners im nordwestlichen Theile des Teutoburger Waldes bei Langerich. *Jahrb. d. k. preussisch. geol. Landesanst.* für 1881. (Berlin, 1882.) [Lamellibranchs, pp. 21, 24, 29, 34, 43.]

Wollemann, A. Kurze Uebersicht über die Bivalven und Gastropoden des Hilsconglomerats bei Braunschweig. *Zeitschr. d. deutsch. geol. Gesellsch.*, vol. xlviii (1896), p. 830.

—— *Fimbria corrugata* (Sow.) aus dem Hilsconglomerat von Schandelah. *Ibid.*, vol. li (1899), p. 592.

—— Die Bivalven und Gastropoden des deutschen und holländischen Neocoms. *Abhandl. d. k. preussisch. geol. Landesanst.*, N. F., Heft 31. 1900.

—— Die Fauna des Senons von Biewende bei Wolfenbüttel. *Jahrb. d. k. preussisch. geol. Landesanst.* für 1900, vol. xxi (1901), pt. iii, p. 1. [Lamellibranchs, pp. 13—23.]

—— Einige Bemerkungen über die Dicke der Schale der *Aucella Keyserlingi*. *Centralbl. für Min., etc.* (1901), p. 497.

—— Aufschlüsse und Versteinerungen im Turon des Kreises Braunschweig und Wolfenbüttel einschliesslich des Oderwaldes. *Jahresber. Vereins Naturwiss. Braunschweig*, vol. xii (1901), p. 50. [Lamellibranchs, pp. 55, 56.]

—— Die Fauna der Lüneburger Kreide. *Abhandl. d. k. preussisch. geol. Landesanst.*, N. F., Heft 37. 1902. [Lamellibranchs, pp. 49—80.]

Woods, H. Catalogue of the Type Fossils in the Woodwardian Museum, Cambridge. 1891. [Lamellibranchs, pp. 68—93.]

—— The Mollusca of the Chalk Rock. Part ii. *Quart. Journ. Geol. Soc.*, vol. liii (1897), p. 377.

Woodward, S. An Outline of the Geology of Norfolk. Norwich, 1833. [Lamellibranchs, pls. v and vi.]

Woodward, S. P. On the Structure and Affinities of the Hippuritidæ. *Quart. Journ. Geol. Soc.*, vol. xi (1855), p. 40.

—— Note on *Plicatula sigillina*, an undescribed fossil of the Upper Chalk and Cambridge Phosphate-bed. *Geol. Mag.*, vol. i (1864), p. 112.

Yokoyama, M. Versteinerungen aus der japanischen Kreide. *Palæontographica*, vol. xxxvi (1890), p. 159. [Lamellibranchs, pp. 174—176, 194—197, 198—200.]

Zittel, K. A. Die Bivalven der Gosaugebilde in den Nordöstlichen Alpen. I. Dimyaria. *Denkschr. d. k. Akad. d. Wissensch. Wien, Math.-nat. Classe*, vol. xxiv, pt. i (1865). II. Monomyaria. *Ibid.*, vol. xxv, pt. ii (1866).

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1899.

LONDON:

MDCCCXCIX.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

ST. JOHN'S COLLEGE, CAMBRIDGE.

PART I.

NUCULANIDÆ, NUCULIDÆ, ANOMIIDÆ, AND ARCIDÆ.

PAGES 1—72; PLATES I—XIV.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1899.

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C., AND 20, HANOVER SQUARE, W.

DESCRIPTION OF SPECIES.

Class—LAMELLIBRANCHIA, *Blainville*.

Family—NUCULANIDÆ, *Stoliczka*.[1]

Genus—NUCULANA, *H. F. Link*, 1807.

('Beschreib. der Naturalien-Samml. der Universität zu Rostock,' vol. iii, p. 155.)

1. *Lower Cretaceous Species.*

NUCULANA SPATHULATA (*Forbes*), 1845. Plate I, figs. 1, 2 *a*—*c*, 3.

1845.	NUCULA SPATHULATA,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 245, pl. iii, fig. 4.
1854.	LEDA SPATHULATA,	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 205.
1866.	— —	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.
1884.	— —	*J. S. Gardner.*	Quart. Journ. Geol. Soc., vol. xl, p. 139 (*partim*), pl. v, fig. 30 ? (*non* 31—34).

Description.—Shell thin, compressed, elongate, very inequilateral; short and rounded anteriorly; long and rapidly tapering posteriorly, with a faint carina extending from the umbo to the postero-ventral extremity, and cutting off a flattened area, which is ornamented with lines of growth only. Posterior extremity truncated and somewhat rounded. Antero-dorsal border slightly convex; postero-dorsal border nearly straight, with a slight ventral slope. Umbones small. Surface (except the postero-dorsal part) ornamented with numerous fine concentric ribs.

Measurements:

	(1)	(2)
Length . . .	14·5 . .	16·0 mm.
Height . . .	6·5 . .	6·0 ,,

(1) In the Wiltshire Collection, Woodwardian Museum, Pl. I, figs. 2, 3.

(2) The type (a cast), Pl. I, fig. 1.

[1] For accounts of the classification of the *Nuculanidæ* see G. Seguenza, "Nuculidi terziare d' Italia," 'Atti della R. Accad. dei Lincei,' ser. 3a, vol. i (1877), p. 1163; and A. E. Verrill and K. J. Bush, 'Amer. Journ. Sci.,' ser. 4, vol. iii (1897), p. 51. Owing to the imperfect preservation of the interiors of many of the Cretaceous forms of this group, *Nuculana* is here used in the extended sense.

Affinities.—D'Orbigny[1] considered that this species was identical with his *N. lingulata*;[2] but that form was founded on a cast, so that an exact comparison cannot be made. *N. lingulata*, however, appears to be more pointed posteriorly and to taper more regularly than *N. spathulata*; it is also shorter anteriorly. *N. spathulata* is distinguished from *N. solea* (d'Orbigny) by its ornamentation and less elongate form.

Remarks.—This appears to be a rare species; I have seen only six examples of it. Several of the specimens recorded by Gardner do not belong to this species, but to *N. scapha* (d'Orbigny) (see p. 4). The example from Speeton which he figures may be *N. spathulata*, but it is in the form of a cast, and the posterior part is not perfect.

Types.—The type (Pl. I, fig. 1) is an internal mould, but shows indications of the ribbing; it comes from the Atherfield Clay, and is in the collection of the Geological Society of London (No. 2112).

Distribution. — Crackers of Atherfield; Atherfield Clay of Atherfield; ? Speeton Clay of Speeton.

NUCULANA SUBRECURVA (*Phillips*), 1829. Plate I, figs. 4 *a*—*c*, 5 *a*, *b*.

1829.	NUCULA SUBRECURVA,	*J. Phillips.*	Geol. Yorks., pt. 1, p. 122, pl. ii, fig. 11.
1854.	— —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 217.
1866.	— —	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. des Envir. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.
1884.	LEDA SUBRECURVA,	*J. S. Gardner.*	Quart. Journ. Geol. Soc., vol. xl, p. 135, pl. v, figs. 24, 25.
Non 1844.	NUCULA SUBRECURVA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 170, pl. ccci, figs. 7—11.
— 1850.	LEDA SUBRECURVA,	*d'Orbigny.*	Prod. de Pal., vol. ii, p. 136.
— 1867.	— —	*O. Fraas.*	Aus dem Orient, pt. i, p. 92.

Description.—Shell inflated, elongate, inequilateral, the posterior part being much longer than the anterior; ventral margin gently curved; extremities rounded; posterior part wedge-shaped; anterior part narrow. Lunule depressed, not distinctly limited. Surface with concentric grooves and concentric striæ.

Measurements:

	(1)	(2)
Length . . .	18 . .	18 mm.
Height . . .	10 . .	11 ,,
Thickness . . .	10 . .	11 ,,

[1] 'Prodr. de Pal.,' vol. ii (1850), p. 117.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 168, pl. cccix, figs. 1—3.

Affinities.—The shell in *N. subrecurva* is more inequilateral, and more pointed at the extremities, than in *N. phaseolina* (d'Orbigny), and the latter is ornamented with concentric ribs.

Remarks.—Phillips gave no description of this species, and his figure is an outline only, but is sufficiently characteristic to enable us to identify the form.

Types.—I have not seen the type of *N. subrecurva*. An internal cast from Speeton (8 mm. in length) in the York Museum is labelled as such, but it does not belong to this species. The specimens figured by Gardner are in the Leckenby Collection, Woodwardian Museum.

Distribution.—Speeton Clay (D 3 and D 4) of Speeton.

NUCULANA SPEETONENSIS, sp. nov. Plate I, figs. 6 *a*, *b*, 7 *a*, *b*.

? NUCULA EQUILATERALIS, *Bean MS.*, ron *F. A. Römer*. Die Verstein. d. Norddeutsch. Oolithgeb. (1836), p. 101, pl. vi, fig. 13.

Description.—Valves almost equilateral, about twice as long as high, convex, anterior and posterior extremities almost equally rounded. Ventral margin slightly curved, almost parallel to the dorsal. Umbones nearly central, close together, of moderate size, with a depression in front and behind. Surface ornamented with numerous fine concentric striæ.

Measurements :

	(1)	(2)	
Length . . .	17 . .	18	mm.
Height . . .	10 . .	9·5	,,

Affinities.—This species resembles *Leda Neckeriana*, Pictet and Roux, from the Gault; but in that form the umbones are larger and more widely separated, and the shell appears to be less equilateral.

N. phaseolina, Michelin, is smaller than *N. speetonensis;* it is also more angular posteriorly, not quite so equilateral, and apparently more coarsely ornamented.

Types.—In the British Museum, and the Museum of Practical Geology, Jermyn Street.

Distribution.—Speeton Clay of Speeton.

NUCULANA [? YOLDIA] SCAPHA (*d'Orbigny*), 1844. Plate I, figs. 8 *a*—*c*, 9—14.

1844. NUCULA SCAPHA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 167, pl. ccci, figs. 1—3.
1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 245.
1854. LEDA SCAPHA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 205.
1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 395, 400, pl. cxxix, fig. 2.

1881. Yoldia (Nucula) scapha, *K. A. Zittel.* Handb. d. Palæont., vol. ii, p. 54.
1884. Leda scapha, *J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 138 (*partim*), pl. v, fig. 23 ? (*non* 21, 22).
1884. — spathulata, *Gardner.* Ibid., p. 139 (*partim*), pl. v, figs. 31—34.
? 1884. — scapha, *O. Weerth.* Die Fauna des Neocom. im Teutoberg. Walde (Palæont. Abhandl., vol. ii), p. 46.
? 1898. — — ? *A. J. Jukes-Browne.* Geol. Mag., dec. 4, vol. v, p. 29.
Non 1867. — (Nucula) scapha, *O. Fraas.* Aus dem Orient, pt. i, p. 92.

Description.—Shell elongate, oval, compressed, a little inequilateral; ventral margin nearly parallel to the dorsal; rounded anteriorly, tapering slightly and more compressed and pointed posteriorly. Postero-dorsal margin concave; antero-dorsal straight or slightly convex. Lunule linear. Surface ornamented, except near the anterior and posterior ends, with fine concentric striæ.

Measurements:

	(1)	(2)	(3)
Length	15	13	9 mm.
Height	7·5	6·5	5 ,,

Affinities.—The form of the shell in this species is similar to that of *N. lineata* (Sowerby), but it is more compressed and generally larger; the ornamentation also is much finer.

N. scapha differs from *N. Mariæ* (d'Orbigny) in being relatively longer, less convex, and less pointed posteriorly. It appears to differ from *N. scaphoides* (Pictet and Campiche) in its greater relative length, in having the postero-dorsal margin less concave, in the finer ornamentation, and its smaller size.

The form of the shell in *N. scapha* is suggestive of the genus *Yoldia*, to which it was referred by Stoliczka.[1] I am unable to give a definite opinion on this point, since the specimens which I have examined do not show the interior of the shell.

Remarks.—Some of the examples considered by Gardner (pl. v, figs. 31—34) to be *Leda spathulata*, Forbes, certainly belong to this species.

Specimens in the British Museum (Gardner Collection, No. L 5109), from Atherfield, were referred to *N. scapha* by Gardner (pl. v, figs. 21, 22, *vide supra*), but are more convex than that species, and probably belong to *N. lineata* (Sowerby) (see p. 8).

Types.—I have not seen the type; it is not preserved in the d'Orbigny Collection at Paris. Of the specimens figured by Gardner as *Leda scapha*, the original of his figs. 21 and 22 is preserved in the British Museum; the original of fig. 23 is stated to be in the Woodwardian Museum, but is now missing. Of the examples figured by the same author as *Leda spathulata*, the original of fig. 32

[1] "Palæont. Indica," 'Cret. Fauna S. India,' vol. iii (1871), p. 324.

is in the Woodwardian Museum, and the original of fig. 33 in Mr. Meÿer's Collection; the originals of figs. 31 and 34 are missing.

Specimens from the Atherfield Clay of Hythe and Atherfield, which Forbes states were identified by d'Orbigny, are in the museum of the Geological Society of London (Nos. 2107, 2115).

Distribution.—Atherfield Clay of Atherfield, Sevenoaks, and Hythe; *Perna* bed of East Shalford; Lower Greensand near Devizes; Speeton Clay (C 3) of Speeton.

NUCULANA SEELEYI (*Gardner*), 1884. Plate I, figs. 15 *a*, *b*, 16 *a*, *b*, 17 *a*, *b*.

1884. LEDA SEELEYI, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 137, pl. v, figs. 17—19 (*non* 20).

Description.—Shell oval, nearly equilateral, high and rounded at the extremities; moderately convex; somewhat flattened. Ventral margin gently curved. Umbones rather small, almost median. Surface smooth.

Measurements:

	(1)	(2)
Length . . .	7 . .	10 mm.
Height . . .	5 . .	7 ,,
Thickness . . .	3 . .	5·5 ,,

Affinities.—*N. Seeleyi* is distinguished from *N. Vibrayeana* (d'Orbigny) by the higher and more evenly rounded extremities, by the larger apical angle, by the gentler curve of the ventral margin, and by the central part of the valves being somewhat flatter.

Types.—In the Woodwardian Museum (figs. 17, 18 of Gardner) and the British Museum (figs. 19, 20).

Distribution.—Speeton Beds (C 3 and C 9) of Speeton.

2. *Gault and Upper Greensand Species.*

NUCULANA SOLEA (*d'Orbigny*), 1844. Plate I, figs. 18—24.

1844. NUCULA SOLEA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 170, pl. cccix, figs. 4—6.

1850. LEDA SOLEA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.

1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.

1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl. p. 139, pl. iii, fig. 30.

Description.—Shell thin, greatly elongated, compressed; the anterior part short and rounded; the posterior part very long and tapering, with a slight carina extending from the umbo to the postero-ventral angle, cutting off a flattened area. Umbones small. Ventral margin slightly sinuous posteriorly (except in young specimens, in which the posterior part of the valve is less produced); postero-dorsal nearly straight. Posterior margin truncated. Surface glossy, with very fine concentric lines. Margin entire. Teeth very numerous, minute, short. Adductor impressions faintly marked.

Measurements:

	(1)	(2)	(3)	(4)	
Length	26	20	14	10	mm.
Height	9	7	5	4	,,

Affinities.—*N. solea* is more elongated than any other Cretaceous species here described (see page 1).

Types.—I have not seen the type; it appears to be missing from the d'Orbigny Collection in the Museum of Natural History, Paris. Gardner's specimens are in the British Museum.

Distribution.—Lower Gault (zones ii, iii, v, vii) of Folkestone; Gault of Black Ven; Cambridge Greensand (*fide* Price).

Nuculana Mariæ (*d'Orbigny*), 1844. Plate I, figs. 25 *a*—*c*, 26 *a*, *b*, 27.

1844. Nucula Mariæ, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 169, pl. ccci, figs. 4—6.
1850. Leda Mariæ, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 136.
1866. — — *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 397, 401.
1884. — — *J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 138, pl. iii, figs. 28, 29.

Description.—Shell elongated, inequilateral. Ventral margin considerably and evenly curved; antero-dorsal straight or slightly convex, postero-dorsal slightly concave, both with a considerable ventral slope. Anterior end blunt and rounded; posterior end pointed. Posterior part of shell more compressed than the median and anterior portions. Umbones pointed. Surface ornamented with numerous fine, concentric ribs, which are absent or indistinct on the anterior and posterior parts of the valves. Anterior teeth about thirteen, posterior more.

Measurements:

	(1)	(2)	(3)	
Length	8	7	4	mm.
Height	5	4	3	,,
Thickness	3·5	—	—	,,

Affinities.—This species is much smaller and less inequilateral than *N. scaphoides* (Pictet and Campiche). For its relations to *N. scapha* (d'Orbigny), *N. lineata* (Sowerby), and *N. angulata* (Sowerby), see pp. 4, 7, 8.

Types.—I have not seen the type. The specimens figured by Gardner are in the British Museum.

Distribution.—Lower Gault (zones ii, and iv to vii) of Folkestone. Gardner records it also from the Folkestone Beds and the Upper Gault.

NUCULANA LINEATA (*Sowerby*), 1836. Plate I, figs. 28 *a*, *b*, 29, 30, 31 *a*—*d*, 32 *a*—*c*.

1836. NUCULA LINEATA, *J. de C. Sowerby.* Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 9.
1850. LEDA LINEATA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 159.
1854. NUCULA LINEATA, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 217.
1868. LEDA LINEATA, *A. Briart and F. L. Cornet.* Descript. Mineralog., Géol., et Pal. de la Meule de Bracquegnies (Mém. Cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 63, pl. vi, figs. 8, 9.
1884. — — *J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 136, pl. iv, figs. 13—16 (? 14).
1884. — SCAPHA, *Gardner.* Ibid., p. 138 (*partim*), pl. v, figs. 21, 22 ?
Non 1837. NUCULA LINEATA, *A. Goldfuss.* Petref. Germ., vol. ii, p. 153, pl. cxxiv, fig. 17 (from the St. Cassian Beds).
— 1841. — — *G. Münster.* Petrefactenkunde, pt. iv, p. 83, pl. viii, fig. 9.
— 1875. LEDA LINEATA, *J. F. Blake.* Quart. Journ. Geol. Soc., vol. xxxi, p. 228, pl. xii, fig. 12 (from the Kimmeridgian); vol. xxxvi (1880), p. 235.

Description.—Shell small, oval, elongate, somewhat compressed, rounded anteriorly, pointed posteriorly; posterior part a little longer than the anterior. Ventral margin slightly curved. Umbones not very prominent. Lunule often indistinct. Escutcheon lanceolate. Surface ornamented with well-marked concentric ribs, which disappear or become indistinct near the postero-dorsal and antero-dorsal extremities: some of the ribs cut the ventral margin obliquely near its posterior end. Margins smooth.[1] Teeth numerous, slightly bent.

Measurements:

	(1)	(2)	(3)
Length	12	10	8 mm.
Height	7	6	4·5 ,,
Thickness	—	—	3 ,,

Affinities.—In this species the ribs are coarser and fewer, and the posterior part of the shell is less sharply pointed and less compressed, than in *N. Mariæ*

[1] Gardner says "the lip is strongly crenated internally." I have seen no indication of this in any specimen.

(d'Orbigny). For the relation of this to *N. scapha* (d'Orbigny) and *N. phaseolina* (Michelin), see pp. 4, 9.

Remarks.—Specimens referred to *N. scapha* (d'Orbigny) by Gardner (*vide ante*, p. 4), and stated to come from the Lower Greensand of Atherfield, probably belong to this species. One example is figured on Pl. I, fig. 32.

Types.—The types, and also the specimens figured by Gardner, are in the Bristol Museum.

Distribution.—Blackdown Greensand (zone x); Greensand of Haldon (*fide* Downes); Grey Chalk of Dover (*fide* Gardner).

NUCULANA ANGULATA (*Sowerby*), 1824. Plate I, figs. 33 *a*—*c*, 34 *a*, *b*, 35 *a*—*d*.

1824.	NUCULA ANGULATA,	*J. de C. Sowerby.*	Min. Conch., vol. v, p. 120, pl. cccclxxvi, fig. 5.
1850.	LEDA ANGULATA,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 159.
1854.	— —	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 205.
1866.	— —	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.
1884.	— —	*J. S. Gardner.*	Quart. Journ. Geol. Soc., vol. xl, p. 138, pl. iv, figs. 17—19.

Description.—Shell small, more or less oval or triangular, moderately convex; somewhat rounded anteriorly, pointed posteriorly. Ventral margin regularly curved, but slightly sinuous posteriorly. Umbones prominent, incurved; a ridge extends from each umbo both anteriorly and posteriorly, limiting two depressed areas. Ornamentation consists of fine concentric ribs. Anterior and posterior portions of the hinge-line of nearly equal length; teeth narrow, elongate.

Measurements:

	(1)	(2)	(3)
Length	5·5	5	4 mm.
Height	4	3·5	3 ,,
Thickness	3	3	2·2 ,,

(2) is one of Sowerby's types.

Affinities.—This species is similar to *N. Mariæ* (d'Orbigny), but is smaller, more convex, with the posterior part of the shell usually less elongated, and the umbones more prominent.

Types.—In the British Museum. The specimens figured by Gardner are in the Bristol Museum.

Distribution.—Blackdown Greensand.

NUCULANA PHASEOLINA (*Michelin*), 1836. Plate II, figs. 1 *a*—*d*, 2 *a*, *b*, 3.

1836. NUCULA PHASEOLINA, *H. Michelin*. Mém. Soc. Géol. France, vol. iii, p. 102, pl. xii, fig. 6.
1844. — SUBRECURVA, *A. d'Orbigny* (non *Phillips*). Pal. Franç. Terr. Crét., vol. iii, p. 170, pl. ccci, figs. 7—11.
1850. LEDA SUBRECURVA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.
1866. — PHASEOLINA, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. des Envir. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 135, pl. iii, figs. 22—24 (pl. v, figs. 26—29 ?).

Description.—Shell oval, rather high, convex, nearly equilateral; anterior extremity broadly rounded; posterior somewhat pointed and slightly compressed; ventral margin nearly parallel to the dorsal. Umbones prominent. Lunule indistinctly defined. Escutcheon oval, deep, not sharply limited posteriorly. Surface ornamented with numerous fine, close-set, concentric ribs, which are indistinct or absent on the posterior part of the shell; a few of the later ribs cut the postero-ventral margin obliquely.

Measurements:

Length	10·5 mm.
Height	7 ,,
Thickness	7 ,,

Affinities.—This species is similar to *N. lineata* (Sowerby), but is more equilateral, relatively shorter, more rounded at the extremities, and the ornamentation is finer.

Nuculana Neckeriana (Pictet and Roux) is larger and more convex than *N. phaseolina*, and is apparently ornamented with lines of growth only.

Remarks.—Michelin's figure and description are very unsatisfactory, and the characters of his species can only be determined from the works of later writers and from specimens in French collections. The average size of the French specimens appears to be greater than that of the English.

Types.—I have not seen the type. D'Orbigny's specimens are in the Museum of Natural History, Paris. Gardner's specimens are in the British Museum.

Distribution.—Lower Gault of Folkestone.

NUCULANA VIBRAYEANA (*d'Orbigny*), 1844. Plate II, figs. 4 *a*—*c*, 5 *a*, *b*, 6—9.

1844. NUCULA VIBRAYEANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 172, pl. cccl, figs. 12—14.
1850. LEDA VIBRAYEANA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.
1852. NUCULA VIBRAYEANA, *F. J. Pictet and W. Roux*. Moll. foss. Grès vert de Genève, p. 471, pl. xxxix, fig. 2.
1861. — SUBELLIPTICA, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 120, pl. vi, fig. 4.
1861. — RHOMBOIDEA, *Seeley*. Ibid., p. 120, pl. vi, fig. 5.
1866. LEDA VIBRAYEANA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 399, 401, pl. cxxix, figs. 5, 6.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 137, pl. iii, figs. 17, 18, 25; pl. iv, figs. 26, 27.

Description.—Shell oval, rounded, convex centrally, compressed at the extremities, nearly equilateral, but with the posterior part slightly longer than the anterior; extremities rounded. Ventral margin considerably curved at the median part. Antero-dorsal and postero-dorsal margins with a considerable ventral slope from the umbo. Umbones not prominent. Lunule indistinct. Escutcheon lanceolate. Surface smooth. Margins smooth. Anterior adductor impression somewhat quadrate; the posterior a little smaller and more rounded. Pallial line slightly sinuous posteriorly.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	15	13	11	11	10	9	6·5	mm.
Height	12	10	8	9	8	7	5·5	,,
Thickness	8	6	6	5·5	5	4·5	3	,,

Affinities.—See under *N. Seeleyi*, Gardner (p. 5).

Remarks.—As was pointed out by Gardner, Seeley's *N. subelliptica* (Pl. II, fig. 9), and *N. rhomboidea* from the Cambridge Greensand, are simply internal casts of *N. Vibrayeana*.

Types.—I was unable to find the type in the d'Orbigny Collection at the Museum of Natural History, Paris. The types of *N. subelliptica*, Seeley, and *N. rhomboidea*, Seeley, are in the Woodwardian Museum, Cambridge. The examples figured by Gardner are in the British Museum.

Distribution.—Lower Gault (zones v, vii, and viii) of Folkestone; Cambridge Greensand (derived).

3. *Chalk Species.*

NUCULANA, sp., cf. SILIQUA (*Goldfuss*). Plate II, figs. 10 *a*, *b*.

1837. NUCULA SILIQUA, *A. Goldfuss.* Petref. Germ., vol. ii, p. 156, pl. cxxv, fig. 13.
1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. ii, p. 7, pl. xxxiv, fig. 11.
1850. LEDA SILIQUA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 236.
1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. ii. Die Weissenberger und Malnitzer Schichten, p. 117, fig. 18.
1885. NUCULANA SILIQUA, *F. Nötling.* Die Fauna der baltisch. Cenoman.-Geschiebe (Palæont. Abhandl., vol. ii, pt. iv), p. 27, pl. iv, fig. 15.
1889. NUCULA SILIQUA, *O. Griepenkerl.* Die Verstein. der Senon. Kreide von Königslutter (Palæont. Abhandl., vol. iv), p. 57.
1889. LEDA SILIQUA, *E. Holzapfel.* Die Mollusken der Aachener Kreide (Palæontographica, vol. xxxv), p. 203.
1892. — — *F. Vogel.* Verhandl. der naturh. Ver der preuss. Rheinl., &c., vol. xlix, p. 73.
1893. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. v. Priesener Schichten, p. 92.
1895. — — *F. Vogel.* Die holland. Kreide, p. 37.
1897. NUCULANA, cf. SILIQUA, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 378.

Non 1842. NUCULA SILIQUA, *H. B. Geinitz.* Char. d. Schichten u. Petref. d. sächs.-böhm. Kreidegeb., pt. iii, p. 77, pl. xx, figs. 28, 29.

Remarks.—There are two specimens in the Montagu Smith Collection (Woodwardian Museum), which agree well with the figures of *N. siliqua* given by Goldfuss and Reuss—especially the latter; but since, like the figured specimens, they are in the form of casts, it is difficult to be sure of their identity. This form may perhaps belong to the sub-genus *Perrisonota*, Conrad.[1]

Measurements:

Length	16 mm. (approximate).
Height	6 ,,

Type.—The type comes from the Aachen Greensand.

Distribution.—Chalk Rock (*Reussianum*-zone) of Cuckhamsley.

[1] 'American Journal of Conchology,' vol. v (1869), p. 98, pl. ix, fig. 24.

Family—NUCULIDÆ, *Gray*.

Genus—NUCULA, *Lamarck*, 1799.[1]

('Mém. Soc. Hist. Nat. Paris,' p. 87.)

1. *Lower Cretaceous Species.*

NUCULA PLANATA, *Deshayes*, 1842. Plate II, figs. 11 *a*, *b*, 12 *a*, *b*, 13, 14 *a*, *b*, 15.

1829. NUCULA OVATA, *J. Phillips* (non *Mantell*). Geol. Yorks., pt. 1, pl. ii, fig. 10, p. 122.

1842. — PLANATA, *G. P. Deshayes*. In *A. Leymerie*, Mém. Soc. Géol. de France, vol. v, p. 7, pl. ix, figs. 3, 4.

1844. — OBTUSA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 163, pl. ccc, figs. 1—5 (named *N. planata* on pl. ccc).

1858. — IMPRESSA, *F. J. Pictet and E. Renevier*. Foss. du Terr. Aptien de la Perte du Rhone, &c. (Matér. Pal. Suisse, ser. 1), p. 108, pl. xv, figs. 5, 6.

1866. — PLANATA, *F. J. Pictet and G. Campiche*. Moll. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 404, 417, pl. cxxix, fig. 7.

1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 126, pl. v, figs. 1—4.

Description.—Shell oval; short and angular posteriorly, high and rounded anteriorly; ventral margin considerably curved. Postero-dorsal margin nearly straight. Lunule elongate, bounded by a blunt carina. Shell depressed in front of the umbones. A faint ridge extends from the umbones anteriorly. Surface with lines of growth only.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	27	20	14·5	16·5	16	mm.
Height	17·5	14	9	11·5	·5	,,
Thickness	—	—	6·5	—	—	,,

1—3 are from Speeton; 4 and 5 from Atherfield.

[1] In the genus *Nucula* I regard the *posterior* dorsal area as the lunule, and the *anterior* dorsal as the escutcheon, since, except in position, they agree precisely with the lunule and escutcheon of other genera. In this matter I am in accord with Sylvanus Hanley (Mon. "Nuculidæ," in Sowerby's 'Thesaurus Conchyliorum,' vol. iii [1866], p. 147, foot-note).

Affinities.—The characters in which this species differs from *N. ovata*, Mantell, are—(i) the greater curvature of the ventral margin, (ii) the angular form of the posterior end of the shell, (iii) the absence of the constriction at the ventral margin, (iv) the absence of the sinuosity at the postero-ventral angle, (v) the usually more distinctly limited lunule. The characters i, ii, and v also serve to separate *N. planata* from *N. obtusa*, Sowerby. In *N. impressa*, Sowerby, the shell is smaller and relatively shorter, and the lunule more depressed and relatively wider than in *N. planata*. *N. Cornueliana*, d'Orbigny,[1] appears to me to be very closely allied to, if not identical with, *N. planata*, and is regarded by Pictet and Campiche as simply a variety of *N. planata*; they state that it differs from the latter in being proportionately thicker, and in having the anterior part of the shell shorter, so that the apical angle is a little smaller. In *N. simplex*, Deshayes, the posterior part is much shorter than in *N. planata*.

Types.—I have not seen the type. There are examples in the d'Orbigny Collection in the Museum of Natural History, Paris. Specimens figured by Gardner are in the Woodwardian Museum, and in Mr. Meÿer's Collection. A specimen which is regarded as the original of Phillips's *N. ovata* is preserved in the York Museum.

Distribution.—Specton Clay (C 8 and D 4); Crackers of Atherfield; *Perna* bed of Redcliff, Isle of Wight.

NUCULA, sp. Plate II, figs. 16 *a*, *b*, 17.

1884. NUCULA CORNUELIANA, *J. S. Gardner* (non *d'Orbigny*). Quart. Journ. Geol. Soc., vol. xl, p. 129, pl. v, figs. 5, 6 (*non* 8—10).

Description.—Shell oval, rather convex, smooth except for growth-lines. Posterior part short. Anterior extremity rounded. Postero-dorsal margin nearly straight, forming with the ventral margin almost a right angle. Ventral margin slightly curved. Lunule distinct, elongate.

Measurements:

Length	17 mm.
Height	12 ,,
Thickness (approximate) . . .	12 ,,

[1] D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 165, pl. ccc, figs. 6—10. De Loriol, 'Anim. Invert. Foss. du Mte. Salève' (1861), p. 84, pl. x, fig. 6. Pictet and Campiche, "Foss. du Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 4), pt. iii, p. 406, pl. cxxix, fig. 8. *Non* J. S. Gardner, 'Quart. Journ. Geol. Soc.,' vol. xl (1884), p. 129, pl. v, figs. 5—10.

Affinities.—This form was referred by Gardner to *N. Cornueliana*, d'Orbigny, but it differs from that in (1) the lesser curvature of the ventral margin; (2) the longer postero-dorsal margin; (3) the greater ventral slope of the antero-dorsal margin. It appears to me to be allied to *N. simplex*, Deshayes,[1] but at present I am unable to speak definitely of its affinities.

Distribution.—Claxby Ironstone (zone of *Bel. lateralis*) of Benniworth Haven; Lower Greensand of Potton.

Nucula Lamplughi, sp. nov. Plate II, figs. 18 *a*, *b*, 19.

Description.—Shell oval, relatively short, rather convex in the umbonal region, but somewhat compressed and tapering anteriorly; extremities rounded. Ventral margin gently curved. Umbones of moderate size. Lunule oval, not sharply limited. Surface of shell smooth except for lines of growth.

Measurements:

	(1)	(2)
Length	22	17 mm.
Height	16	13 „
Thickness	11	9 „

Affinities.—This species is relatively shorter, more rounded posteriorly, and has its lunule less distinctly limited than *N. planata*, Deshayes. It is relatively higher in the umbonal region and tapers more anteriorly than *N. ovata*, Mantell.

Types.—In Mr. Lamplugh's Collection.

Distribution.—Speeton Clay (D 4) of Speeton.

Nucula, sp. Plate II, figs. 20 *a*—*d*.

1884. Nucula simplex, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 129, pl. v, figs. 11—13.

Description.—Shell small, triangular, smooth, somewhat compressed. Umbones small. Apical angle small. Lunule distinct. Posterior part of shell very

[1] 'Mém. Soc. Geol. de France,' vol. v (1842), pl. ix, fig. 5, p. 7. D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1843), p. 166, pl. ccc, figs. 11—15. Pictet and Campiche, "Foss. du Terr. Crét. de Ste. Croix" ('Matér. Pal. Suisse,' ser. 4), pt. iii, p. 407. *Non* Gardner, 'Quart. Journ. Geol. Soc.,' vol. xl (1884), p. 129, pl. v, figs. 11—13.

short. Anterior extremity rounded. Antero-dorsal margin slightly curved. Postero-dorsal margin short, nearly straight. Ventral margin gently curved.

Measurements:

Length	7	mm.
Height	5·5	,,
Thickness	3·25	,,

Remarks.—There are a few specimens of this small species in the British Museum and one or two in Mr. Meÿer's Collection. One in the British Museum was figured by Gardner as *N. simplex*, Deshayes, but it seems to me to be distinct from that form—it is smaller, much more triangular, and has a smaller apical angle. Until a larger series of specimens has been obtained I do not feel justified in giving this form a distinctive name.

Distribution.—Lower Greensand of Atherfield and Shanklin.

NUCULA MEŸERI, *Gardner*, 1884. Plate II, figs. 21 *a*—*c*.

1884. NUCULA MEŸERI, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 130, pl. v, figs. 14—16.

Remarks.—This form is at present very imperfectly known. It is small, triangular, and high; with lines of growth, and a large lunule. Gardner states that "it is most nearly allied to *N. impressa* of Blackdown," but it seems to be almost indistinguishable from *N. antiquata*, Sowerby.

Measurements:

	(1)	(2)	
Length	8·5	8·5	mm.
Height	8	7	,,

1 is the type specimen; 2 is from Redcliff.

Types.—In the British Museum.

Distribution.—Lower Greensand of Atherfield; *Perna*-bed of Redcliff.

2. *Gault and Upper Greensand Species.*

NUCULA PECTINATA, *Sowerby*, 1818. Plate II, figs. 22, 23 *a—c*, 24—26, 27 *a—c*; Plate III, figs. 13 *a*, *b*.

1818. NUCULA PECTINATA, *J. Sowerby.* Min. Conch., vol. ii, p. 209, pl. cxcii, figs. 6, 7.
1822. — — *G. Mantell.* Foss. S. Downs, p. 94, pl. xix, figs. 5, 6, 9.
1838. — — *H. Michelin.* Mém. Soc. Géol. de France, vol. iii, p. 102.
1844. — — *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 177, pl. ccciii, figs. 8—14.
1850. — — — Prodr. de Pal., vol. ii, p. 138.
1852. — — *F. J. Pictet and W. Roux.* Moll. foss. des Grès verts de Genève, p. 472, pl. xxxix, fig. 3.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 217.
1855. — — *G. Cotteau.* Moll. Foss. de l'Yonne, p. 84.
1862. PORTLANDIA PECTINATA, *J. G. Chenu.* Man. de Conchyl., &c., vol. ii, p. 180, fig. 907.
1866. NUCULA PECTINATA, *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Mater. Pal. Suisse, ser. 4), pt. 3, pp. 413, 418, pl. cxxix, fig. 13.
1884. — — *J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 132, pl. iii, figs. 15, 16.
1897. — — *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 90.

Non 1846. — — *A. E. Reuss.* Die Verstein. der böhm Kreideformat., pt. 2, p. 5, pl. xxxiv, figs. 1—5.
— 1850. — — *H. B. Geinitz.* Das Quadersandstgeb. oder Kreidegeb. in Deutschland, p. 160.
— 1850. — — *A. Alth.* Geog.-pal. Beschrieb. der nächst. Umgeb. von Lemberg. Haidinger's Naturw. Abhandl., vol. iii, pt. 2, p. 171.
— ? 1868. — — *E. Eichwald.* Lethæa Rossica, vol. ii, p. 586, pl. xxii, fig. 17.
— 1872. — — *F. Schmidt.* Resultate du Mammuthexpedition. Mém. de l'Acad. Imp. des Sci. de St. Pétersb., ser. 7, vol. xviii, No. 1, p. 152, pl. ii, fig. 6.
— 1873. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 2, p. 57, pl. xvii, figs. 3—5.
— 1877. — — *A. Fritsch.* Stud. im Geb. der böhm Kreideformat. ii. Die Weissenberg. und Malnitz. Schichten, p. 117, fig. 79.

? Non 1852.	Nucula pectinata, *R. Kner.*			Denkschr. d. k. Akad. Wissensch. Math.-nat. Cl., vol. iii, p. 312.
— 1885.	—	—	*F. Nötling.*	Die Fauna der baltisch. Cenomangeschiebe (Palæont. Abhandl., vol. ii, pt. 4), p. 27, pl. iv, fig. 12.
— 1889.	—	—	*A. Fritsch.*	Stud. im Geb. der böhm. Kreideformat. iii. Die Teplitzer Schichten, p. 78.
— 1893.	—	—	—	Ibid. v. Priesener Schichten, p. 91.
— 1897.	—	—	*A. Hennig.*	Revis. af Lamellibr. i Nilsson's 'Petrif. Suecana,' p. 58, pl. iii, fig. 30.

Description.—Shell thick, triangular or somewhat rhomboidal; convex, slightly compressed anteriorly; antero-dorsal border long, slightly convex; postero-dorsal much shorter and concave; ventral margin curved, the arc of the curve often increasing towards the anterior extremity. Posterior extremity angular; anterior rounded or slightly angular. Umbones prominent, curved inwards and posteriorly; usually placed rather near the posterior end of the shell. Lunule deeply depressed, broad, cordate, flattened, smooth except for growth-lines; escutcheon long, nearly smooth except for growth-lines. Surface ornamented with numerous (usually 50 to 52) radiating and rounded ribs, separated by narrower grooves; the grooves, and sometimes also the ribs (especially on the earlier portion of the shell), are crossed by numerous growth-lines. There are often also a few distant concentric depressions. A small rib is placed in the grooves of some of the larger specimens. Teeth: anterior about 22, posterior about 9. Adductor impressions deep, near the margins; the anterior a little larger than the posterior. Margins of valves rather coarsely crenulated.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	29	27	26·5	20	17	mm.
Postero-dorsal margin	12·5	13	12	9	7·5	,,
Antero-dorsal margin	22	23	19	14	13	,,
Height	18	19	17·5	15	11	,,
Thickness	—	—	15	11	8·5	,,

Affinities.—This species is distinguished from *N. tenera*, Müller,[1] and *N. pulvillus*, Müller,[2] of the Aachen Greensand by its coarser ornamentation, its greater length, broader lunule, &c. From *N. arduennensis*, d'Orbigny, it is said to differ in the deep lunule and the strong ribs.

Remarks.—The specimens from the Plänerkalk of Hundorf, &c., and the Plänermergel of Luschitz, &c., which are referred to this species by Reuss, are relatively shorter, and the umbones more acute; the examples figured by that

[1] J. Müller, 'Mon. der Petrefact. der Aachen Kreidef.,' pt. i (1847), p. 17, pl. ii, fig. 1. E. Holzapfel, "Moll. der Aachen Kreide" ('Palæontographica,' xxxv, 1889), p. 200, pl. xxi, figs. 9—12.

[2] Müller, ibid., Supplement (1859), p. 11, pl. vii, fig. 11. Holzapfel, ibid., p. 201, pl. xxi, figs. 7, 8.

author are apparently all casts, so that an exact comparison cannot be made. Geinitz considers that specimens which he obtained from the Plänerkalk of Strehlen and Weinböhla, and from the Plänermergel of Walkmühle near Pirna, belong to *N. pectinata*; but they appear to differ from the English specimens in that the posterior part of the shell is rounded and relatively longer.

The variations seen in different examples of this species are chiefly in the proportions of length and breadth, and in the form of the curve of the ventral margin, the latter giving to the shell a triangular or a rhomboidal outline.

N. striatula, Römer,[1] *N. truncata*, Nilsson,[2] and *N. Blochmanni*, Geinitz,[3] have been regarded by Geinitz and Reuss as identical with *N. pectinata*, Sowerby.

Types.—The types, now in the British Museum, are labelled "Sussex." The specimens figured by Mantell (except fig. 5) and those figured by Gardner are likewise preserved in the British Museum.

Distribution.—Through all the zones of the Gault at Folkestone; Gault of Burham, Aylesford, Black Ven, Devizes, Campton (East Bedfordshire), Ely and Haddenham (Cambs.); Marls with *Bel. minimus* at Speeton; Upper Greensand of Warminster (cast only seen).

NUCULA PECTINATA, *Sowerby*, var. CRETÆ, *Gardner*, 1884. Plate III, figs. 14 *a*, *b*, 15.

1884. NUCULA PECTINATA, var. CRETÆ, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 132.

Remarks.—This form appears to differ from *N. pectinata*, Sowerby, only in being proportionately shorter. The surface of the shell, in the two specimens which I have seen, is somewhat abraded, but I do not think that the ornamentation differs from that of *N. pectinata*.

Without more examples I am unable to say whether this form is really distinct from *N. pectinata*.

Measurements:

Length	15 mm.
Height	12 „
Thickness	9 „

Types.—In the Museum of Practical Geology (Nos. 6449, 6450).

Distribution.—Blackdown Greensand.[4]

[1] 'Die Verstein. der norddeutsch. Kreidegeb.' (1841), p. 68, pl. viii, fig. 26 (the type comes from the Plänerkalk of Strehlen).

[2] 'Petrif. Suecana' (1827), p. 16, pl. v, fig. 6.

[3] 'Char. der Schicht. u. Petref. d. sachs. Kreidegeb.,' pt. ii (1840), p. 50, pl. x, fig. 8.

[4] Erroneously stated by Gardner to come from the *Grey Chalk* of Devon.

Sub-genus—Acila, *H. and A. Adams*, 1858.

('Genera of Recent Mollusca,' vol. ii, p. 545.)

Nucula (Acila) bivirgata, *Sowerby*, 1836. Plate III, figs. 1, 2 *a*—*c*, 3, 4, 5 *a*—*c*, 6—12.

1836.	Nucula bivirgata,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 335, pl. xi, fig. 8.
1844.	—	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 176. pl. cccciii, figs. 1—7.
1844.	—	ornatissima, *d'Orbigny.*	Ibid., p. 175, pl. cccii, figs. 9—12.
1854.	—	bivirgata, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 217.
1854.	—	ornatissima, *Morris.*	Ibid., p. 217.
1855.	—	bivirgata, *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 84.
1866.	—	— *F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 418.
1866.	—	ornatissima, *Pictet and Campiche.*	Ibid., p. 418.
1875.	—	bivirgata, *A. J. Jukes-Browne.*	Quart. Journ. Geol. Soc., vol. xxxi, p. 299, pl. xv, figs. 4—8.
1884.	—	— *J. S. Gardner.*	Quart. Journ. Geol. Soc., vol. xl, p. 132, pl. iii, figs. 12—14; pl. iv, figs. 20—22.

Description.—Shell oval, convex, angular posteriorly, rounded anteriorly. Antero-dorsal margin slightly convex, postero-dorsal concave. Ventral margin evenly curved. Lunule cordate, depressed, ornamented with transverse ribs; central part elevated. Escutcheon narrow, elongate, not sharply limited, ornamented with ribs. Surface of shell ornamented with numerous fine radiating ribs crossed by delicate lamellæ; the ribs diverge at an acute angle from a line extending from the umbo in an antero-ventral direction. In some cases the ribs diverge from two lines near together, forming an inverted W, thus M. New ribs may become intercalated between the others, especially near the margins of the valves of larger specimens. Margins of valves crenulated. Teeth: posterior about six, anterior about twelve. Adductor impressions distinct, rounded, near the margins; the anterior larger than the posterior.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length . . .	19	16	14	15	18·5	23	18	mm.
Height . . .	13	12	10	12	13	15·5	13	,,
Antero-dorsal margin .	16	14	11	11·5	16	20	15	,,
Postero-dorsal margin .	9	8	7	7	8	11	8	,,
Thickness . . .	—	—	—	—	11	—	12·5	,,

6 and 7 are Gardner's figured specimens of *N. ornatissima* and *N. bivirgata* respectively.

Affinities.—The forms in which the ribs diverge from two lines (thus ⋀) were regarded by d'Orbigny as constituting a distinct species—*N. ornatissima;* the only difference being in the form of the ornamentation, and this feature is not constant: in some cases the ribs on the earlier part of the shell diverge from one line, whereas on the later part they diverge from two lines, or the reverse may be the case. The adductor impressions are not so deep in *N. bivirgata* as they are in *N. pectinata.*

N. Dewalquei, Briart and Cornet,[1] from the Meule de Bracquegnies, is very closely related to *N. bivirgata*, but in the former the line from which the ribs diverge is directed more anteriorly than it is in the latter species. *N. Dewalquei* is stated by the writers mentioned to be longer in proportion to its width than *N. bivirgata;* I have seen no examples of the former.

N. picturata, Yokoyama,[2] from the Upper Cretaceous of Poronai (Japan), is also allied to *N. bivirgata;* I have seen no specimen of that form, and the figures do not enable me to make an exact comparison.

Remarks.—The variation in the proportions of length and breadth is fairly considerable. In some cases the line from which the two sets of ribs diverge cuts the ventral border of the valve near its middle point, but in others more anteriorly, the position varying in different examples.

Types.—I have not seen the type; it is apparently lost. The specimens figured by Gardner (except figs. 20—22) are in the British Museum; one of those figured by Jukes-Browne (fig. 6) is in the Woodwardian Museum, Cambridge.

Distribution.—Lower Gault (zones v and vii) of Folkestone; also, perhaps, Upper Gault, according to Gardner (?). Gault of Black Ven. Cambridge Greensand.

[1] "Descript. Min., Géol., et Paléont. de la Meule de Bracquegnies" ('Mém. couron. et Mém. des Sav. étrang. Acad. Roy. Belg.,' vol. xxiv, 1868), p. 62, pl. v, figs. 26—28.

[2] "Verstein. aus der japanisch. Kreide," 'Palæontographica,' vol. xxxvi (1889), p. 18, pl. xxv, figs. 1, 2.

NUCULA OVATA, *Mantell*, 1822. Plate III, figs. 16—18, 19 *a*, *b*, 20, 21 *a*, *b*; Plate IV, figs. 1 *a*, *b*.

1822. NUCULA OVATA, *G. Mantell.* Foss. S. Downs, p. 94, pl. xix, figs. 26, 27.
1838. — CAPSÆFORMIS, *H. Michelin.* Mém. Soc. Géol. de France, vol. iii, pl. xii, fig. 8, p. 102.
1844. — OVATA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 173, pl. cccii, figs. 1—3.
1850. — — — Prodr. de Pal., vol. ii, p. 137.
1852. — — *F. J. Pictet and W. Roux.* Moll. foss. des Grès verts de Genève, p. 473, pl. xxxix, fig. 4.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 217.
1866. — — *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. des Envir. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3 pp. 409, 417, pl. cxxix, fig. 9.
1874. — DERANCEI, *F. G. H. Price.* Quart. Journ. Geol. Soc., vol. xxx, p. 358, pl. xxv, fig. 7.
1874. — OVATA, *Price.* Ibid., p. 357, pl. xxv, fig. 6.
? 1878. — — *O. Fraas.* Aus dem Orient, pt. ii, p. 81.
1884. — — *J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 125, pl. iii, figs. 1—3; pl. iv, figs. 28—30.
1884. — CAPSÆFORMIS, *Gardner.* Ibid., p. 127, pl. iii, figs. 4, 5.

Non 1827. NUCULA OVATA, *S. Nilsson.* Petrif. Suecana, p. 16, pl. v, fig. 5.
— 1829. — — *J. Phillips.* Geol. Yorks., pt. 1, pl. ii, fig. 10, p. 122.
— 1837. — — *W. Hisinger.* Lethæa Succica, p. 59, pl. xviii, fig. 7.
— 1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 8, pl. xxxiv, fig. 25.
— 1889. — — *O. Griepenkerl.* Die Verstein. der Senon. Kreide von Königslutter (Palæont. Abhandl., vol. iv), p. 56.
— 1893. — — *A. Fritsch.* Stud. im Geb. der böhm. Kreideformat. v. Priesener Schichten, p. 92, fig. 103.
— 1897. — — *A. Hennig.* Revision af Lamellibr. i Nilsson's 'Petrifacta Suecana,' p. 63, pl. iii, fig. 21.

Description.—Shell oblong or ovate-oblong, short posteriorly, compressed, with a slight constriction near the margin opposite the umbo; central part of the ventral margin straight and nearly parallel to the dorsal; anterior margin rounded, forming an obtuse angle with the dorsal; posterior margin slightly angular, but sometimes somewhat rounded. Umbones not much curved. A slight depression usually extends from near the umbo to just below the posterior angle, giving a slight sinuosity to the margin at that point. Lunule ovate, not much depressed, sometimes ill-defined. Surface smooth, but with lines of growth; and in a few cases faint indications of radial ribs, seen chiefly near the middle of the valve. Margins smooth. Adductor impressions shallow.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length . . .	33	29	27	26	22·5	21	19	18	mm.
Height . . .	21	20	17	15	13	15	13·5	12·5	,,
Thickness . . .	14	12	—	—	—	11	9	9·5	,,

Affinities.—The larger forms of this species, described by Michelin as *N. capsaeformis*, and subsequently named *N. Deranceï* by Price, have been regarded by some authors as distinct from Mantell's *N. ovata*, but practically the only difference is in size: in France a perfect gradation has been traced between these two types; and a similar passage, although it is stated by Gardner not to exist, can be seen in English specimens. In England the larger forms are recorded by Price from zones i and ii only of the Lower Gault. *N. ovata* is related to *N. obtusa*, Sowerby; the points which distinguish the two are given on p. 23.

Remarks.—The variations in the relative proportions of the length, height, and thickness are fairly great, as will be seen from the table of measurements. The antero-dorsal border may be parallel to the ventral, or may slope more or less obliquely to it. The posterior extremity is commonly somewhat angular, but may be rounded.

Types.—I have not been able to trace Mantell's specimens. The examples figured by Gardner and referred to above (except, perhaps, figs. 28 to 30) are in the British Museum.

Distribution.—Through all the zones (except vii) of the Gault at Folkestone; Gault of Black Ven; Cambridge Greensand (derived); Upper Greensand of Devizes.

NUCULA OBTUSA, *Sowerby*, 1836. Plate IV, figs. 2 *a*, *b*, 3, 4 *a*—*d*.

1836.	NUCULA OBTUSA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 11.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 163.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 217.
? 1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 415, 418, pl. cxxix, fig. 15.
1884.	—	—	*J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 126, pl. iv, figs. 1, 2.
Non 1844.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 163, pl. ccc, figs. 1—5 (named *N. planata* on pl. ccc).

Description.—Shell oval or ovate-oblong, moderately convex, rounded anteriorly and posteriorly; ventral margin evenly curved. Umbones not prominent, placed posteriorly. Lunule indistinctly defined. Surface smooth, but with growth-lines. Hinge with numerous small teeth about eighteen on the anterior part, and nine on the posterior,—the two parts forming an obtuse angle (about 133°).

Measurements:	(1)	(2)
Length	21 . .	20 mm.
Height	13 . .	14 ,,
Thickness . . .	13 . .	— ,,

Affinities.—*N. obtusa* is closely allied to *N. ovata*, Mantell; it differs from the latter (1) in being more oval, (2) in having the ventral margin more regularly curved, (3) in the umbones being usually placed more posteriorly, (4) in the absence of a constriction near the ventral margin, and (5) in the indistinct lunule.

Types.—The type is in the Bristol Museum. The specimen figured by Gardner is in the Museum of Practical Geology, Jermyn Street.

Distribution.—Blackdown Greensand (zones vii to x); Greensand of Haldon (*fide* Downes); Upper Greensand of Devizes and Warminster.

NUCULA IMPRESSA, *Sowerby*, 1824. Plate IV, figs. 5, 6 *a*—*c*, 7, ? 8 *a*, *b*.

1824.	NUCULA	IMPRESSA, *J. de C. Sowerby.*	Min. Conch., vol. v, p. 118, pl. ccccl xxv, fig. 3.
? 1836.	—	APICULATA, *J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 10.
1850.	—	IMPRESSA, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 163.
1854.	—	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 217.
? 1854.	—	APICULATA, *Morris.*	Ibid., p. 217.
1866.	—	IMPRESSA, *F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 418, pl. cxxix, fig. 16.
1884.	—	— *J. S. Gardner.*	Quart. Journ. Geol. Soc., vol. xl, p. 128, pl. iv, figs. 9—12.
Non 1846.	NUCULA	IMPRESSA, *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 6, pl. xxxiv, figs. 6, 7.
— 1867.	—	— *E. Guéranger.*	Album Paléont. du Dép. de la Sarthe, p. 15, pl. xx, fig. 16.
— 1897.	—	— *A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. vi. Die Chlomeker Schichten, p. 56, fig. 61.

Description.—Shell oval, rounded anteriorly, angular posteriorly; ventral margin evenly curved, postero-dorsal margin slightly concave. Umbones placed

very near the posterior end. Lunule elongate, much depressed, sharply limited. Surface with lines of growth. Margins entire. Anterior part of hinge-line with about eighteen teeth, posterior part with seven.

Measurements :

	(1)	(2)	(3)	(4)	(5)
Length . . .	13·5	11·5	11	10	9 mm.
Height . . .	10	8·5	8	7	6 ,,
Thickness . .	—	—	5·5	4·75	4·5 ,,

Affinities.—This species is distinguished from *N. obtusa*, Sowerby, and *N. ovata*, Mantell, by the sharply defined lunule and the angular posterior extremity; it is also a smaller form.

N. apiculata, Sowerby (Plate IV, fig. 8), from Blackdown, appears to me to be only a variety of *N. impressa;* it is somewhat shorter in proportion to its height than the ordinary forms of *N. impressa*, and consequently has a more rounded outline. Sowerby's diagnosis of *N. apiculata* is "Convex, smooth, transversely obovate; posterior extremity pointed." A specimen in the Museum of the Geological Society of London (No. 1564, Fitton Collection) is, I believe, the type, but is a little smaller than Sowerby's figure. The only other example known to me is in Mr. Meÿer's Collection. The late Rev. W. Downes[1] considered *N. apiculata* to be a synonym of *N. antiquata*, Sowerby; but that species is more triangular in outline, the valves are much more convex, and the umbones more prominent.

Types.—One of the types (Sowerby's lower figure) is in the British Museum. One of the specimens figured by Gardner (fig. 12) is in the Bristol Museum; I have not seen the others; they are stated to be in the Rev. W. Downes' Collection, now in the Exeter Museum.

Distribution.—Blackdown Greensand.

NUCULA ALBENSIS, *d'Orbigny*, 1844. Plate IV, figs. 9 *a*, *b*, 10, 11, 12 *a*, *b*, 13 *a*, *b*, 14 *a*, *b*, 15 *a*, *b*, 16, ? 17.

1844.	NUCULA ALBENSIS,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 172, pl. ccci, figs. 15—17.
1850.	—	—	Prodr. de Pal., vol. ii, p. 137.
1866.	—	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 411, 417, pl. cxxix, fig. 11.
1884.	—	*J. S. Gardner.*	Quart. Journ. Geol. Soc., vol. xl, p. 128, pl. iii, figs. 6—8; pl. iv, figs. 24, 25.

[1] 'Trans. Dev. Assoc.,' vol. xii (1880), p. 436; and 'Quart. Journ. Geol. Soc.,' vol. xxxviii (1882), p. 88.

Description.—Shell subtriangular or more or less oval, compressed; posterior part very short and somewhat angular; anterior part usually tapering rapidly, with the extremity rounded. Ventral margin curved evenly. Antero-dorsal margin curved; postero-dorsal nearly straight or slightly concave. Umbones not prominent, curved. Lunule shallow, cordate, often not sharply defined. Anterior area limited by a faint ridge. Surface smooth, but with lines of growth. Margin smooth. Adductor impressions shallow.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	22	17	15	14·5	12	mm.
Height	15·5	12	11	10	10	,,
Thickness	—	—	8	6	—	,,

Affinities.—*N. Timotheana*, Pictet and Roux,[1] is shorter, and apparently more compressed than is *N. albensis; N. ovata*, Mantell, is less compressed and more rounded in outline; *N. impressa*, Sowerby, is more oval, and has a more depressed and better defined lunule.

Remarks.—This species varies considerably in the proportions of length and height—the shorter examples being more triangular, the longer more oval in outline. A form found in the Blackdown Greensand (Plate IV, fig. 17), of which I have seen only a few specimens, approaches very closely the shorter types of *N. albensis*, but I have not sufficient material to allow me to speak of its affinities with certainty.

Types.—I have not seen the type; it appears to be missing from the d'Orbigny Collection in the Museum of Natural History, Paris. Some of the specimens figured by Gardner (figs. 6—8) are in the British Museum.

Distribution.—Lower Gault (zone vi) of Folkestone; Gault of Black Ven; Cambridge Greensand (derived). ? Grey Chalk (*fide* Gardner).

NUCULA GAULTINA, *Gardner*, 1884. Plate IV, figs. 18 *a*—*c*, 19, 20, 21 *a*—*c*.

1884. NUCULA GAULTINA, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 134, pl. iii, figs. 9—11, 26, 27.

Description.—Shell small, triangular, rather convex; pointed anteriorly and posteriorly. Ventral and antero-dorsal margins gently curved; postero-dorsal margin slightly concave. Umbones pointed, curved, placed very posteriorly. Lunule cordate, sharply defined. Anterior area bounded by a ridge passing from the umbo to the anterior extremity. Surface nearly smooth, but with lines of

[1] Moll. Foss. Grès verts de Genève (1852), p. 176, pl. xxxix, fig. 7.

growth, crossed by very indistinct radial ribs. Margin crenulate. Hinge and adductor impressions not seen.

Measurements:

	(1)	(2)	(3)
Length	10	9	8 mm.
Height	8	7	6 ,,

Affinities.—This species is distinguished from *N. impressa*, Sowerby, by its more triangular outline and larger lunule. It is less convex and proportionately longer than *N. antiquata*, Sowerby, and has less prominent umbones. It is smaller, more pointed at the extremities, and has a deeper and more sharply limited lunule than *N. albensis*, d'Orbigny.

Types.—In the British Museum.

Distribution.—Lower Gault (zones v, vi, and vii) of Folkestone.

NUCULA ANTIQUATA, *Sowerby*, 1824. Plate IV, figs. 22 *a*—*c*, 23 *a*, *b*, 24 *a*, *b*, 25, 26.

1824. NUCULA ANTIQUATA, *J. de C. Sowerby.* Min. Conch., vol. v, p. 118, pl. cccclxxv, fig. 4.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 217.
1866. — — *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 418.
1884. — — *J. S. Gardner.* Quart. Journ. Geol. Soc., vol. xl, p. 134, pl. iv, figs. 3—8.

Description.—Shell very convex, triangular, posterior angle rounded, anterior somewhat pointed; ventral margin curved. Umbones prominent, curved, placed very posteriorly. Lunule very broad, cordate, smooth, depressed, sharply defined. An anterior area is cut off by a ridge passing from the umbones to the anterior margin. Surface ornamented with fine, slight, radiating ribs crossed by well-marked concentric growth-lines. Margins crenulate. Anterior part of the hinge-line has about twenty teeth, and is bent almost at right angles to the posterior part, which has about nine teeth; the anterior part is more than twice the length of the posterior part. Adductor impressions rounded, the anterior being the larger.

Measurements:

	(1)	(2)	(3)	(4)
Length	13	11	10	12 mm.
Antero-dorsal margin	12·5	10	9·5	11 ,,
Postero-dorsal margin	6	4·5	4·5	5 ,,
Height	11·5	8·5	8	9 ,,
Thickness	9	7·5	—	— ,,

Affinities.—This species is distinguished by the convexity and triangular form of the valves, and by the broad and deep lunule. *N. apiculata*, Sowerby, was regarded by the late Rev. W. Downes as a synonym of *N. antiquata* (see p. 24).

Types.—In the British Museum. The specimens figured by Gardner (except fig. 6, which is in the Downes Collection) are in the Bristol Museum.

Distribution.—Blackdown Greensand (zones vii to x).

3. *Chalk Species.*

NUCULA, sp. Plate IV, figs. 27, 28.

1897. NUCULA, sp., *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 378, pl. xxvii, figs. 1, 2.

Remarks.—A species of *Nucula* is represented in the Montagu Smith Collection (Woodwardian Museum, Cambridge) by eleven specimens; it approaches closely in form d'Orbigny's *N. Renauxiana*[1] found in the Turonian of Uchaux, but unfortunately all the specimens are internal casts, so that an exact determination is impossible.

Measurements:

Length	13 mm.
Height	10 ,,

Distribution.—Chalk Rock (*Reussianum*-zone) of Cuckhamsley.

Family—ANOMIIDÆ, *Gray.*

Genus—ANOMIA, *Linnæus*, 1758.

('Syst. Nat.,' ed. 10, p. 700.)

1. *Lower Cretaceous Species.*

ANOMIA PSEUDORADIATA, *d'Orbigny*, 1850. Plate V, figs. 1 *a*—*c*, 2, 3.

1836. ANOMIA RADIATA, *J. de C. Sowerby* (non *Risso*). Trans. Geol. Soc., ser. 2, vol. iv, p. 338, pl. xiv, fig. 5.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 179, pl. cccix, figs. 7—9. This is regarded by Pictet and Campiche ('Foss. Terr. Crét. Ste. Croix,' pt. iii [1866], p. 418) as a synonym of *N. impressa*, Sowerby.

1850. Anomia pseudoradiata, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 84.
1854. — radiata, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 161.
Non ? 1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. ii, p. 45.
— 1877. — — ? *A. Fritsch*. Stud. im Gebiete der böhm. Kriedef. ii. Die Weissenb. und Malnitz. Schichten, p. 142, fig. 142.

Description.—Shell oval, a little irregular, higher than long. Left valve moderately convex, ornamented with numerous radial ribs, which on the adult shell are more distinct and more wavy than on the younger part of the shell, and of two sizes, the larger being distinctly granular. The radial ribs are sometimes crossed by concentric growth-lines. Umbo near the margin.

Measurements:

	(1)	(2)	(3)
Length	22	20	21 mm.
Height	23	22	24 ,,

Affinities.—This species appears to be similar to *A. subtruncata*, d'Orbigny,[1] from the Plänerkalk of Strehlen, &c., but in that form the shell is much more regularly oval than in *A. pseudoradiata*.

Types.—In the Museum of the Geological Society (No. 2029), from the Hythe Beds, near Sandgate.

Distribution.—Crackers, &c., of Atherfield; Ferruginous Sands (upper beds) of Shanklin; Hythe Beds, near Sandgate; Atherfield Beds of East Shalford, Sevenoaks, and Redhill.

Anomia, sp. Plate V, figs. 4, 5 *a*, *b*.

Description.—Shell more or less orbicular or oval, and rather inequilateral. Left valve moderately convex with a rather prominent umbo at the margin; ornamented with radial ribs, which are slender, widely separated, only a little elevated, and rather irregular.

Measurements:

	(1)	(2)
Length	17	9 mm.
Height	16	8·5 ,,

Affinities.—In *A. costulata*, Römer,[2] the umbo is not at the margin and is somewhat spiral, and the ribs are more numerous; the last is also the case in

[1] *A. truncata*, Geinitz (*non* Linnæus), 'Char. d. Schicht. und Petref. sächs.-böhm. Kreidegeb.,' pt. iii (1842), p. 87, pl. xix, figs. 4, 5; and "Das Elbtalgeb. in Sachsen" ('Palæontographica,' vol. xx), pt. 2 (1872), p. 30, pl. viii, figs. 22, 23. *A. subtruncata*, A. d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 171.

[2] 'Die Verstein. Nord-deutsch. Ool-geb. Nachtrag' (1839), p. 21, pl. xviii, fig. 5.

A. intercostata, Zittel.[1] The ornamentation in this form resembles that of *A. subradiata*, Reuss,[2] but in that species the shell appears to be less inequilateral.

Remarks.—I have seen only two examples of this form; it appears to be quite distinct from the other English species, and to resemble most *A. subradiata*, Reuss, from the Plänermergel of Luschitz.

Distribution.—Crackers of Atherfield.

ANOMIA LÆVIGATA, *Sowerby*, 1836. Plate V, figs. 6, 7 *a*, *b*, 8 *a*, *b*, 9.

1836.	ANOMIA LÆVIGATA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 338, pl. xiv, figs. 6 *a*, *b*.
?1847.	—	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 755, pl. cccclxxxix, figs. 4—6.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 84.
1851.	—	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 161.

Description.—Shell regular, nearly orbicular; surface smooth except for lines of growth. Left valve moderately convex; umbo small, at or near the margin.

Measurements:

	(1)	(2)	(3)
Length	36	22	14 mm.
Height	32	21	13 ,,

Types.—One of the types (Pl. V, fig. 6, and Sowerby's fig. 6 *a*), from the Hythe Beds of Lympne, is in the Museum of Practical Geology (No. 6114); I have not seen the other.

Distribution.—Ferruginous Sands (upper beds) of Shanklin; Atherfield Beds of Peasmarsh; Hythe Beds of Lympne; Lower Greensand of Punfield.

ANOMIA CONVEXA, *Sowerby*, 1836. Plate V, figs. 10 *a*, *b*.

1836.	ANOMIA CONVEXA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 338, pl. xiv, fig. 7.
1851.	—	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 161.

Description.—Shell rather small, more or less orbicular or quadrate; surface smooth, or with fine ribs. Left valve very much inflated, with a rather prominent umbo.

[1] 'Die Bivalven der Gosaugeb.,' pt. ii (1866), p. 51, pl. xix, fig. 10.

[2] 'Die Verstein. der böhm. Kreideformat.,' pt. ii (1846), p. 45, pl. xxxi, figs. 18, 19.

Measurements :

Length	14 mm.
Height	13 ,,

Remarks.—This species is imperfectly known at present. The only specimens I have seen are in the Museum of the Geological Society, and in Mr. Meÿer's Collection. With regard to the type specimen, Sowerby remarks, "The furrows are produced by a *Terebratula* [*? Rhynchonella*] to which this specimen was attached, and to which it consequently bears a great resemblance."

Types.—The type, from the Lower Greensand of Shanklin, is in the Museum of the Geological Society (No. 2032).

Distribution.—Lower Greensand of Redhill (Reigate) and Atherfield; Ferruginous Sands (upper beds) of Shanklin.

2. *Gault and Upper Greensand Species.*

ANOMIA, sp.; *cf.* PSEUDORADIATA, *d'Orbigny*. Plate V, figs. 11 *a*, *b*.

Remarks.—This form appears to differ from *A. pseudoradiata*, d'Orbigny, only in having finer and less distinct ribs; the difference may perhaps be due to the mode of preservation. At present I have seen only two specimens.

Distribution.—Gault of Black Ven (Museum of Practical Geology, No. 6440) and Folkestone.

ANOMIA, spp.

In the Museum of Practical Geology, Jermyn Street, there are several specimens from the Upper Greensand of Devizes and Warminster; some appear to be closely related to *A. lævigata*, Sowerby, others to *A. pseudoradiata*, d'Orbigny, but they are not sufficiently well preserved to allow of exact determination.

3. *Chalk Species.*

ANOMIA ? TRANSVERSA, *Seeley*, 1861. Plate V, figs. 12 *a*, *b*.

1861. ANOMIA ? TRANSVERSA, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 123, pl. vi, fig. 8.

Description.—"Shell ovate, elongated, inflated. Umbo large, prominent, inclining to the posterior end rather than central" (Seeley).

Measurements:

Length	17 mm.
Height	12 ,,

Remarks.—This form may perhaps be related to *A. papyracea*, d'Orbigny, but without better specimens I am unable to make any definite statement concerning it.

Types.—I have not seen the specimen figured by Seeley, but other examples to which he refers are preserved in the Woodwardian Museum, Cambridge.

Distribution.—Cambridge Greensand.

ANOMIA PAPYRACEA, *d'Orbigny*, 1847. Plate V, figs. 13—16.

1847. ANOMIA PAPYRACEA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 755, pl. cccclxxxix, figs. 7—10.

1850. ANOMYA PAPYRACEA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 171.

1881. ANOMIA PAPYRACEA, *A. d'Orbigny*, var. BURWELLENSIS, *R. Etheridge*. In Penning and Jukes-Browne, Geol. Neighbourhood of Cambridge (Mem. Geol. Survey), p. 145, pl. iii, figs. 3, 4.

Description.—Shell more or less oval, longer than high, nearly smooth, but sometimes with faintly marked concentric ribs. Left valve slightly convex; umbo small, near the margin. Right valve flat or slightly concave.

Measurements:

	(1)	(2)	(3)
Length	33	35	28 mm.
Height	23	25	21 ,,

Affinities.—This species is distinguished from *A. lævigata*, Sowerby, by its oval form and lesser convexity.

Types.—The type is not in the d'Orbigny Collection. The specimens figured by Etheridge are in the Woodwardian Museum, Cambridge.

Distribution.—Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell and Reach.

Family—ARCIDÆ, *Lamarck.*

Genus—ARCA, *Linnæus*, 1758 (*sensu stricto*).

('Syst. Nat.,' ed. 10, p. 693.)

1. *Lower Cretaceous Species.*

ARCA DUPINIANA, *d'Orbigny*, 1844. Plate VI, figs. 1 *a*, *b*, 2, 3.

1844.	ARCA DUPINIANA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 207, pl. cccx, figs. 9, 10.
1845.	—	—	*E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 246.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 80.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 185.
1855.	—	—	*G. Cotteau.* Moll. Foss. de l'Yonne, p. 86.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 438, 468.
1867.	—	—	*P. de Loriol.* In *A. Favre*, Recherch. géol. dans Savoie, &c., vol. i, p. 381.
1871.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 342 (*Barbatia*).

Description.—Shell elongate, very inequilateral, convex. Anterior margin rounded. Ventral margin sinuous, roughly parallel to the hinge-line. Posterior margin very oblique, nearly straight, forming sharply marked obtuse and acute angles with the dorsal and ventral margins respectively. Umbones prominent, moderately distant, with a prominent toothed carina extending to the postero-ventral angle, and cutting off a depressed postero-dorsal area. Hinge-line long. Hinge-area rather large. Ornamentation consists of numerous fine radial ribs—more prominent at the anterior end—crossed by concentric growth-lines. Postero-dorsal area with four strong radial ribs which project posteriorly, giving a toothed margin. Teeth numerous, small, transverse, the terminal teeth slightly oblique.

Measurements:

Length	25 mm.
Height	12·5 ,,
Thickness	13 ,,

Affinities.—This species is distinguished by its prominent toothed carina and strong postero-dorsal ribs. Its form is somewhat similar to that of *A. Sancta-Crucis*, Pictet and Campiche (see p. 34), but its posterior margin is more oblique.

It also appears to be related to *Arca Dufrenoyi*, d'Archiac,[1] but in that form the antero-dorsal extremity is rectangular. The hinge of *A. Dufrenoyi* seems to be unknown.

Types.—I have not seen the type; it came from the Neocomian of Marolles (Aube).

Distribution.—*Perna*-bed of Atherfield; Atherfield Beds of East Shalford and Peasmarsh; Ferruginous Sands (upper beds) of Shanklin.

ARCA CARTERONI, *d'Orbigny*, 1844. Plate VI, figs. 4 *a*—*c*, 5 *a*—*c*.

1844.	ARCA CARTERONI,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 202, pl. cccix, figs. 4—8.
1845.	—	—	*E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 246.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 185.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 436, 468, pl. cxxx, fig. 9.
1883.	—	—	*W. Keeping.* Foss., &c., of Neoc. of Upware and Brickhill, p. 114, pl. v, fig. 7.

Description.—Shell oblong, very elongate and thick. Dorsal and ventral margins straight and nearly parallel. Hinge-line extends to the most anterior part of the shell, and forms with the anterior margin a right angle; the anterior margin curves ventrally from the hinge-line. Posterior margin a little oblique. Umbones of moderate size, widely separated, only slightly curved, with a low rounded carina extending to the postero-ventral angle; between the carina and the hinge-line is a second indistinct carina. Hinge-area very broad and large, lozenge-shaped, with several (about seven) ligament-grooves. Ornamentation consists of fine radial ribs. Hinge: the teeth near the umbo are small and transverse, but towards the extremities they become more oblique and longer.

Measurements:	(1)	(2)
Length	40 . .	28 mm.
Height	16 . .	13 ,,
Thickness . . .	20 . .	— ,,

(1) From Upware. (2) From East Shalford.

[1] 'Bull. Soc. Géol. de France,' ser. 2, vol. xi (1854), p. 214, pl. iii, fig. 9.

Affinities.—See *A. Sanctæ-Crucis* (below). The external teeth are more oblique in this than in most forms of *Arca*, in which respect it may be compared with *A. equidens*, Tate.[1]

Distribution.—Lower Greensand of Upware. Atherfield Beds of East Shalford and Peasmarsh. ? *Perna*-bed of Redcliff.

ARCA SANCTÆ-CRUCIS, *Pictet and Campiche*, 1866. Plate VI, figs. 6 *a*—*c*, 7 *a*—*c*.

1866. ARCA SANCTÆ-CRUCIS, *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 437, pl. cxxx, figs. 10, 11.

Description.—Shell elongate, very convex in the umbonal region; wedge-like posteriorly. Anterior margin rounded, more or less perpendicular to the hinge-line. Ventral margin a little sinuous, more or less parallel to the dorsal. Posterior margin nearly straight, and either at right angles or slightly oblique to the hinge-line. Umbones prominent, incurved, placed near the anterior third of the shell. Carina rounded; postero-dorsal area depressed, sometimes slightly concave, with one or two faint broad ridges. Hinge-area long and broad. Ornamentation consists of numerous fine radial ribs crossed by lines of growth. Interior not seen.

Measurements:

	(1)	(2)
Length	31	25 mm.
Height	17	14 ,,
Thickness	16·5	13 ,,

(1) and (2) are from Upware.

Affinities.—This form agrees in many respects with *A. Carteroni*, d'Orbigny, and it is likely that a large series of specimens would show a passage between the two. At present I have seen only three or four examples of each. *Arca Sanctæ-Crucis* appears to differ from *A. Carteroni* in being proportionately shorter, in having the ventral margin sinuous and less parallel to the dorsal, and in the umbones being more prominent and incurved.

It also appears to be similar to *Arca autissiodorensis*, Cotteau,[2] but seems to be less inflated and to have the posterior margin less oblique.

[1] 'Trans. Roy. Soc. S. Australia,' vol. viii (1886), p. 139, pl. xi, fig. 9; G. F. Harris, 'Cat. Tert. Mollusca' (Brit. Mus.), part i (1897), p. 331.

[2] 'Moll. Foss. de l'Yonne' (1855), p. 86; de Loriol and Cotteau, 'Mon. Pal. Géol. de Portlandien de l'Yonne' (1868), p. 179, pl. x, figs. 6, 7.

Type.—From the Valangian of Sainte Croix.

Distribution.—Lower Greensand of Upware. Atherfield Beds of East Shalford.

2. *Upper Cretaceous Species.*

ARCA PHOLADIFORMIS, *d'Orbigny*, 1844.

1844.	ARCA PHOLADIFORMIS,		*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 219, pl. cccxv, figs. 1—3.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 164.
1866.	—	—	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 473.
1867.	—	—	*E. Guéranger.*	Album Paléont. Sarthe, p. 16, pl. xxi, ffgs. 5, 11.
1871.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343.
?? 1883.	—	cf. —	*A. Fritsch.*	Stud. im Geb. der böhm. Kreideformat. iii. Die Iser Schichten, p. 104, fig. 69.

Remarks.—An internal mould of a right valve from the Upper Greensand of Devizes, which almost certainly belongs to this species, is preserved in the Museum of Practical Geology (No. 6454); its length is 28 mm., and its height 11 mm. I have seen no other specimen. The hinge is apparently unknown.

Genus—BARBATIA, *J. E. Gray*, 1847.

['Syn. Brit. Mus.,' 1840, p. 151 (*nom. nud.*); 'Proc. Zool. Soc.,' 1847, p. 197.]

1. *Lower Cretaceous Species.*

BARBATIA APTIENSIS (*Pictet and Campiche*), 1866. Plate VI, figs. 8 *a*—*e*, 9 *a*, *b*.

1845.	ARCA RAULINI,		*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 215 (*partim*).
1850.	—	—	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 80 (*partim*).
1854.	—	—	*J. Morris.*	Cat. Brit. Foss., ed. 2, p. 185.
1857.	—	—	*F. J. Pictet and E. Renevier.*	Foss. du Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 106, pl. xv, figs. 1—3.
? 1865.	—	CYMODOCE,	*H. Coquand.*	Mon. de l'étage Aptien de l'Espagne, p. 140, pl. xii, figs. 7, 8.

1866. Arca aptiensis, *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 454, 471.

1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca?*).

? 1871. — cymodoce, *Stoliczka.* Ibid., p. 345.

? 1884. — Raulini, *O. Weerth.* Die Fauna Neocom. Teutoburg. Walde. (Palæont. Abhand., vol. ii), p. 47.

Description.—Shell oblong, a little higher near the posterior part of the hinge-line than elsewhere, very inequilateral. Anterior margin forming a sharp angle (often about 90°) with the hinge-line, and curving evenly to join the ventral margin, which is slightly curved, and has a general slope posteriorly. Posterior margin oblique, slightly convex, forming obtuse and acute angles with the dorsal and ventral margins respectively—the acute angle being somewhat rounded. Umbones not prominent, close together, with a rounded carina extending in a double curve to the postero-ventral angle, and cutting off a concave triangular area. Shell compressed in front of the umbones. Hinge-line about three quarters of the length of the shell. Hinge-area narrow, elongate. Ornamentation consists of well-marked concentric ribs, and numerous fine radial ribs. On the anterior part of the shell, at intervals, some of the radial ribs become more prominent, and curve anteriorly. On the postero-dorsal area, and also near the carina, at intervals, some of the radial ribs are more elevated than the others, and here the concentric ribs are less distinct than elsewhere. Central teeth small and transverse, lateral teeth oblique.[1]

Measurements:

	(1)	(2)
Length	28	37 mm.
Height	14	21 ,,
Thickness	—	16 ,,

Affinities.—By most authors this species has been referred to *Cucullæa Raulini*, Leymerie,[2] to which it is certainly closely related; in fact, a larger collection of French specimens than I have been able to examine might well show the two forms to be identical. I have not seen the type of *B. Raulini*, nor the original of d'Orbigny's figures, but other specimens in the d'Orbigny Collection and the École des Mines, Paris. Stoliczka remarks on the difference between Leymerie's and d'Orbigny's figures of that species, and suggests that either one figure is incorrect or that they represent two distinct species. I think that the two figures

[1] The characters of the teeth are given on the authority of Pictet and Campiche.

[2] 'Mém. Soc. Géol. de France,' vol. v (1842), pl. x, fig. 1, p. 7; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 204, pl. cccx, figs. 1, 2; Pictet and Campiche, "Foss. du Terr. Crét. de Ste. Croix" ('Matér. Pal. Suisse,' ser. 4), pt. 3, pp. 440, 469.

represent the same form, but that Leymerie's specimen was imperfect in the postero-dorsal region. *B. aptiensis* appears to differ from *B. Raulini* in the greater height of the posterior part of the shell and consequent greater obliquity and curvature of the ventral margin, and in the presence of a few radial ribs, stronger than the others, on the anterior part of the shell. The average size of the English form appears to be greater than that of the French. *B. aptiensis* is also very similar to *A. neocomiensis*, d'Orbigny. Judging from the figure the latter seems to differ chiefly in having the posterior extremity pointed instead of obliquely truncate.

Arca cymodoce, Coquand, is perhaps identical with this form, but its area appears to be shorter.

Types.—From the Crackers of Atherfield and the Aptian of the Perte-du-Rhône and Presta.

Distribution.—*Perna*-bed, Atherfield Clay, and Crackers of Atherfield; Ferruginous Sands of Sandown; Atherfield Beds of Haslemere, East Shalford, and Sevenoaks.

Sub-genus—Scaphula, *Benson*, 1834.

['Proc. Zool. Soc.,' pt. ii, p. 91.]

Barbatia (Scaphula?) Austeni (*Forbes*), 1845. Plate VII, figs. 1 *a*, *b*, 2, 3.

1845. Cardium (Hemicardium)? Austeni, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 244, pl. iii, fig. 3.
1850. Arca Austeni, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 118.
1854. Cardium Austeni, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 192.
1866. Arca Austeni, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 471.

Description.—Shell oval, very oblique and inequilateral. Anterior margin rounded, passing gradually into the curved and oblique ventral margin. Posterior margin a little convex, oblique, forming an acute angle with the ventral margin. Umbones of moderate size, incurved, with a very sharp carina extending to the postero-ventral angle; postero-dorsal area sharply depressed. Hinge-line short. Hinge-area small, triangular, with several ligament-grooves. Ornamentation consists of slightly elevated radial ribs crossed by faintly marked lines of growth; the radial ribs are sometimes indistinct, but on the postero-dorsal area they are more prominent than elsewhere. Interior not seen.

Measurements :

	(1)	(2)
Length	35 . .	21 mm.
Height	21 . .	17 ,,
Umbo to postero-ventral angle .	47 . .	26 ,,

(1) *Perna*-bed, Atherfield. (2) Crackers, Atherfield.

Affinities.—This differs from all other Cretaceous species with which I am acquainted. The form of the shell and the character of its ornamentation agree closely with the recent *Scaphula*, but since in our species the interior is unknown, I refer it with considerable doubt to that sub-genus.

Type.—In the Museum of the Geological Society (No. 2152), from Peasmarsh.

Distribution.—Atherfield Beds of Sevenoaks, Peasmarsh, East Shalford, and Redcliff (Isle of Wight). Crackers and *Perna*-bed of Atherfield.

2. *Upper and Lower Cretaceous Species.*

Barbatia marullensis (*d'Orbigny*), 1844. Plate VII, figs. 4, 5 *a*—*d*, 6 *a*, *b*, 7.

1844. Arca marullensis, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 205, pl. cccx, figs. 3—5.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.
1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 87.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 432, 468, pl. cxxx, figs. 1—4.
1867. — — *P. de Loriol*. In *A. Favre*, Recherch. géol. dans Savoie, &c., vol. i, p. 382.
1869. — — *P. de Loriol and V. Gilliéron*. Mon. pal. et strat. de l'étage Urgon. inf. du Landeron (Mém. Soc. Helvét. des Sci. Nat., vol. xxiii), p. 16, pl. i, fig. 13.
1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 342 (*Barbatia*).
1883. — — *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 114.

Non 1850. Byssoarca marullensis, *J. de C. Sowerby*. In *F. Dixon*, Geol. Sussex, p. 355, pl. xxviii, fig. 11.
— 1878. — — *Sowerby*. Ibid., ed. 2, p. 385, pl. xxviii, fig. 11.

Description.—Shell oblong, inequilateral, rather compressed. Anterior and posterior margins rounded, the postero-dorsal somewhat oblique; ventral margin parallel to the dorsal. Umbones not prominent, rather close; carina near the

umbones only, not well-marked. Postero-dorsal part of the shell sharply compressed. Hinge-area narrow, depressed, with close-set ligament-grooves. Ornamentation consists of many equal-sized radial ribs, separated by narrow grooves, and crossed by less distinct concentric grooves. Occasionally smaller ribs (radial) appear in the grooves. On the postero-dorsal area the radial ribs are broader and more flattened.

Measurements:	(1)	(2)	(3)	(4)	
Length	25·5	31	30	15	mm.
Height	15	28	16	9	,,
Thickness	11	11	—	—	,,

(1) is from Upware; (2)—(4) are from Folkestone.

Affinities.—The shell is more rounded at the extremities and the umbones are less anterior than in *Barbatia Raulini* (d'Orbigny).

B. marullensis is very similar to *Arca Baudoniana*, Cotteau;[1] the latter is of larger size, and may be only an older example of the former. It is also related to *A. aubersonensis*, Pictet and Campiche.[2]

Arca Hugardiana, d'Orbigny, differs in the ventral margin being oblique, and in having coarser radial ribs and less distinct concentric ornament. In *Arca Gallienei*, d'Orbigny, the umbones are more anterior (see p. 41).

Remarks.—I have seen only two examples from the Lower Greensand, both from Upware, but the species has been recorded from Faringdon; it is not common in the Gault. The concentric ornament is not distinctly seen in the Upware specimens, but that is probably due to the somewhat worn nature of the shell.

Types.—Specimens which agree well with the figures are in the d'Orbigny Collection, but I could not identify the type with certainty.

Distribution.—Lower Greensand of Upware, and (*fide* Morris) of Faringdon. Gault (zones iii, vii, x, xi) of Folkestone. ? Cambridge Greensand (internal moulds only).

[1] 'Moll. Foss. de l'Yonne' (1855), p. 86; Pictet and Campiche, "Foss. Terr. Crét. de Ste. Croix" ('Matér. Pal. Suisse,' ser. 4), pt. 3, p. 432, pl. cxxx, fig. 5.

[2] Ibid., p. 433, pl. cxxx, fig. 6.

3. *Upper Cretaceous Species.*

BARBATIA HUGARDIANA (*d'Orbigny*), 1844.

1844.	ARCA HUGARDIANA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 216, pl. cccxiii, figs. 4—6.
1850.	—	—	— Prodr. de Pal., vol. ii, p. 138.
1852.	—	—	*F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 457, pl. xxxvi, fig. 1.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. du Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 460.
1871.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Barbatia*).
1875.	—	—	*A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 299 (*? partim*).

Some internal casts from the Cambridge Greensand (derived) may perhaps belong to this species.

BARBATIA ROTUNDATA (*Sowerby*), 1836. Plate VII, figs. 8 *a—c*.

1836.	ARCA ROTUNDATA,	*J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 8.
1848.	—	ROTUNDITA, *H. P. Nyst.*	Tableau des Espèces vivant et foss. des Arcacées (Mém. Acad. Roy. Belgique, vol. xxii), p. 64.
1854.	—	ROTUNDATA, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 185.
1866.	—	— *F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. iii, p. 473.
1871.	—	— *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Barbatia*).

Description.—Shell moderately convex, oblong, inequilateral, highest posteriorly. Anterior and posterior margins rounded; ventral oblique to the hinge-line, sinuous at the middle. Umbones close together, with an ill-defined posterior carina. Shell much compressed postero-dorsally; also slightly compressed ventral to the umbones. Ornamentation consists of numerous fine radial ribs separated by narrow grooves, and crossed by a few distant concentric growth-lines. Interior not seen.

Measurements:

Length	26 mm.
Height (approximate)	15 ,,

Affinities.—*Barbatia rotundata* appears to be closely related to d'Orbigny's[1] *Arca Raspailli*, but without seeing specimens of the latter, and with only one example of the former before me, I am unable to determine their relationship. *B. rotundata* is much smaller than the figured forms of *A. Raspailli*, and seems to be proportionately more convex.

B. Hugardiana (d'Orbigny) is proportionately longer and more coarsely ribbed. *B. Galliennei* (d'Orbigny) is not so high posteriorly.

Type.—Bristol Museum. This is the only specimen I have seen.

Distribution.—Blackdown Greensand.

Barbatia vendinensis (*d'Orbigny*), 1844.

1844.	Arca vendinensis,		*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 220, pl. cccxv, figs. 4—7.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 164.
1866.	—	—	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 474.
1871.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Barbatia*).
? 1897.	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. vi. Die Chlomeker Schichten, p. 57, fig. 63.

An imperfect right valve from the Chalk Marl (Meyer's Bed 10) of Dunscombe, in Mr. Meyer's Collection, probably belongs to this species.

Barbatia Galliennei (*d'Orbigny*), 1844. Plate VII, figs. 9 *a*, *b*.

1844.	Arca Galliennei,		*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 218, pl. cccxiv.
1850.	-	-	—	Prodr. de Pal., vol. ii, p. 164.
1866.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 473.
1867.			*E. Guéranger.*	Album Pal., p. 16, pl. xxi, fig. 4.
1871.	—	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Barbatia*).
1873.	—	—	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 220, pl. xlviii, figs. 20—22.
1895.	—	—	*E. Tiessen.*	Zeitsch. d. deutsch. geol. Gesellsch., vol. xlvii, p. 482.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 766 (*nom. mut.*); ibid. (as *A. Requieniana*), p. 239, pl. cccxxvi, figs. 1, 2; 'Prodr. de Pal.,' vol. ii (1850), p. 196, No. 137.

Remarks.—I have seen only a few specimens—all internal casts—of this species.

Distribution.—Base of the Chalk Marl (zone of *Schlœnbachia varians*) of Lyme Regis, and Titherleigh, near Chard.

BARBATIA, sp., cf. GEINITZI (*Reuss*), 1844. Plate VII, figs. 10 *a*, *b*, 11.

Cf. 1842. ARCA RADIATA, *H. B. Geinitz* (non *Goldfuss*). Char. der Schicht. und Petref. sächs-böhm. Kreidegeb., pt. 3, p. 78, pl. xx, figs. 13, 14.
— 1844. — GEINITZI, *A. E. Reuss.* Geogn. Skizzen, vol. ii, p. 192.
— 1846. — — — Die Verstein. der böhm. Kreideformat., pt. 2, p. 11, pl. xxxiv, fig. 31.
— 1852. — — ? *R. Kner.* Denkschr. d. k. Akad. Wissensch. Math-nat. Cl., vol. iii, p. 314, pl. xvi, fig. 27.
— 1869. — — *E. Favre.* Moll. Foss. de la Craie des Envir. de Lemberg, p. 125, pl. xii, figs. 15, 16.
— 1873. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 2, p. 55, pl. xvi, figs. 7, 8.
— 1889. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. iv. Die Teplitzer Schichten, p. 79, fig. 63.
1897. — (BARBATIA), sp., cf. GEINITZI, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 378, pl. xxvii, figs. 5, 6.

Measurements:

Length (approximate)	. . . . .	23 mm.
Height ,,	. . . . .	11 ,,

Remarks.—A specimen consisting of an internal and part of an external mould appears to agree with *A. Geinitzi* in form, but seems to differ in possessing rather finer ribs. It is, perhaps, the form figured by J. de C. Sowerby as *Byssoarca marullensis*,[1] from the Chalk of Kent.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

BARBATIA, sp. Plate VII, figs. 12 *a*, *b*.

ARCA, sp., cf. GALLIENNEI, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 378, pl. xxvii, fig. 3.

[1] Sowerby (*non* d'Orbigny), in F. Dixon's 'Geol. Sussex' (1850), p. 355, pl. xxviii, fig. 11. I have not been able to find the original of Sowerby's figure.

Measurements:

Length	33 mm.
Height	19 „

Remarks.—There are two internal casts of left valves from Cuckhamsley in the Montagu Smith Collection, Woodwardian Museum, which, in general form, agree with *A. Gallienaei*, d'Orbigny, except that they are proportionately shorter.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

BARBATIA ? sp. Plate VII, figs. 13 *a*, *b*.

1897. ARCA, sp., *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 379, pl. xxvii, fig. 4.

Description.—Shell elongate, oblique, very inequilateral. Anterior margin forming an angle with the hinge-line, and curving ventrally to join the ventral margin, which is nearly straight, but has a considerable slope posteriorly. Posterior margin oblique, somewhat rounded. Umbones apparently sharp, pointing anteriorly; shell compressed dorsal to a line between the umbo and the postero-ventral extremity. Surface with well-marked lines of growth; radial ribs extend from the umbo posteriorly, and perhaps occur also on other parts of the shell.

Measurements:

Length	13 mm.
Height	6 „

Remarks.—This form is at present known by one specimen only, an internal cast, but showing indications of ornament. It resembles *Arca strehlensis*, Geinitz,[1] from the Pläner-Kalk of Strehlen (Dresden), but in that species the shell is less oblique, and the surface is generally smooth except on the anterior part, which is marked with radial ribs.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

[1] "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx), pt. 2, 1873, p. 56, pl. xvi, fig. 5.

Genus—GRAMMATODON, *Meek and Hayden* (1860), 1864.[1]

['Proc. Acad. Nat. Sci. Philad.,' 1860, p. 419 (list name); "Palæontology of the Upper Missouri," 'Smithsonian Contrib. to Knowledge,' vol. xiv, No. 172, 1864, p. 89, pl. ii, fig. 9.]

GRAMMATODON SECURIS (*Leymerie*), 1842. Plate VII, figs. 14 *a*, *b*, 15 *a*, *b*; Plate VIII, figs. 1, 2.

1829. CUCULLÆA, *J. Phillips*. Geol. Yorks., pt. 1, p. 186, pl. ii, fig. 16.
1842. — SECURIS, *A. Leymerie*. Mém. Soc. Géol. France, vol. v, p. 6, pl. vii, figs. 6, 7.
1844. ARCA SECURIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 203, pl. cccix, figs. 9, 10.
1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 246.
1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 80.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.
1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 87.
1861. — — *P. de Loriol*. Anim. Invert. Foss. du Mont Salève, p. 86, pl. x, fig. 8.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 443, 469.
1875. CUCULLÆA SECURIS, *J. Phillips*. Geol. Yorks., pt. 1, ed. 3, p. 323, pl. ii, fig. 16.
1896. ARCA SECURIS, *A. Wollemann*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 845.

Measurements:

Length	21	mm.
Height	14	,,
Thickness	12·5	,,

Affinities.—This form, as was pointed out by de Loriol, is very similar to *Grammatodon carinatus* (Sowerby) (see p. 45), and I think it is possible that they may prove to be identical, but until more specimens have been obtained I shall regard the two as distinct. In *G. securis* the area appears to be broader than in *G. carinata*; and also on the left valve of the former the ribs are more widely separated than in the latter, and there are small ribs in the interspaces. *Cucullæa Schüsteri*, Roemer,[2] is perhaps an allied form, but I have seen no specimen of it.

Remarks.—The specimen figured by d'Orbigny is proportionately longer than

[1] For the synonymy of this genus see Woods, 'Ann. Mag. Nat. Hist.,' ser. vii, vol. iii (1899), p. 47. To the names there given should be added *Beushausenia*, Cossmann, 'Rev. crit. Paléozool.' (1897), p. 93.

[2] 'Die Verstein des nord-deutsch. Kreidegeb.' (1841), p. 70, pl. ix, fig. 3.

the English forms, but other examples in the d'Orbigny Collection do not differ from ours.

Types.—I have not seen the types; they are stated to have come from Dienville. The specimen from Speeton figured by Phillips (*vide supra*) is in the York Museum.

Distribution.—Speeton Clay (B. zone of *Bel. brunsvicensis*) of Speeton. ? Sandgate Beds of Sevenoaks.

GRAMMATODON CARINATUS (*Sowerby*), 1813. Plate VIII, figs. 3 *a*—*d*, 4 *a*—*c*, 5, 6, 7 *a*, *b*, 8.

1813. ARCA CARINATA, *J. Sowerby*. Min. Conch., vol. i, p. 96, pl. xliv (lower figure).

1824. CUCULLÆA COSTELLATA, *J. de C. Sowerby*. Ibid., vol. v, p. 67, pl. cccexlvii, fig. 2.

1838. — STRIATELLA, *H. Michelin*. Mém. Soc. Géol. de France, vol. iii, p. 102, pl. xii, fig. 11.

1844. ARCA CARINATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 214, pl. cccxiii, figs. 1—3.

? 1846. — (CUCULLÆA) COSTELLATA, *A. E. Reuss*. Die Verstein. d. böhm. Kreideformat., pt. 2, p. 11.

1850. — CARINATA, *A. d'Orbigny*. Prod. de Pal., vol. ii, pp. 138, 164.

1852. — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 462, pl. xxxvii, fig. 1.

1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.

1854. CUCULLÆA COSTELLATA, *J. Morris*. Ibid., p. 197 (not from locality given).

1855. ARCA CARINATA, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 87.

1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 463, 472.

1866. — COSTELLATA, *Pictet and Campiche*. Ibid., p. 471.

1868. — CARINATA, *A. Briart and F. L. Cornet*. Descript. de la Meule de Bracquegnies (Mém. cour. et Mém. des Savants étrang., Acad. Roy. Belg., vol. xxxiii), p. 56, pl. v, figs. 15, 16.

1871. — — and A. COSTELLATA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*? Grammatodon*).

1873. — — *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 223 (?), pl. xlix, figs. 5 (?), 6 (from the Upper Greensand, Isle of Wight).

? 1882. — — *J. Kiesow*. Schrift. nat. Gesellsch. Danzig, N. F., vol. v, p. 239.

? 1895. — — *E. Tiessen*. Zeitsch. d. deutsch. geol. Gesell., vol. xlvii, p. 482.

1897. CUCULLÆA CARINATA, *R. B. Newton*. Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, pp. 72, 84, pl. ii, fig. 6.

Non 1837. Arca carinata, *A. Goldfuss.* Petref. Germ., vol. ii, p. 150, pl. cxxiv, fig. 2.

— 1837. — — *F. C. L. Koch and W. Dunker.* Norddeutsch. Oolithgeb., p. 32, pl. ii, fig. 14.

Description.—Shell elongate, trapezoidal, inflated, inequilateral, rather short anteriorly. Dorsal and ventral margins nearly parallel. Anterior margin joining the ventral in a gradual and regular curve, but forming with the hinge-line a sharp angle, which constitutes the anterior extremity of the valve. Posterior margin oblique, more or less sinuous ventrally, and forming sharply-marked obtuse and acute angles with the dorsal and ventral margins respectively. Umbones rather prominent, much incurved, with a sharp, finely crenulate carina, which extends in a double curve to the postero-ventral angle, and thus cuts off from the rest of the shell a deeply concave postero-dorsal area. Hinge-line nearly or quite equal to the length of the shell. Hinge-area fairly broad, with a varying number (often six or more) ligament-grooves. Surface of shell ornamented with numerous, distinct, rather flattened radial ribs, separated by narrower grooves, and sometimes crossed by concentric striæ. On the anterior part of the shell the radial ribs become narrower, much more elevated, more widely separated, and are crossed by distinct ridges; smaller ribs may be seen in the grooves. In most specimens well-marked growth-lines may be seen at rather distant intervals. On the postero-dorsal area the ribs are narrow and separated by wider depressions; these ribs are more or less crenulate, and are cut by fine concentric ribs, giving a cancellated appearance; a central, and sometimes also two other inner radial ribs, are more elevated than the others. Teeth finely striated, curving obliquely outwards from under the umbo; antero-laterals oblique; postero-laterals long and parallel to the hinge-line. Posterior adductor impression without projecting edge. Margins faintly crenulate.[1]

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	29	45	22	21	24·5	30	mm.
Height	16	29	12	13·5	17	21	,,
Thickness	—	—	—	12	15	21·5	,,

(1) is from the Upper Greensand of Devizes; (2) and (3) are from the Gault of Folkestone; (4—6) are from the Blackdown Greensand.

Affinities.—This species is closely related to *Cucullæa securis*, Leymerie (*vide supra*).

Remarks.—The form described by Sowerby as *Arca carinata* came from the Upper Greensand of Devizes Canal; it has been regarded by d'Orbigny and some other authors as identical with *Cucullæa costellata*, Sowerby, from the Blackdown

[1] Seen only in a few well-preserved specimens.

Greensand, the apparent differences between the two forms being explained by the imperfect state of preservation of the specimens from the Upper Greensand of Devizes. A comparison of a number of examples from these and other localities confirms the view of d'Orbigny.

The specimens from the Gault are, on the average, of larger size than those from the Blackdown Greensand, and, owing to their different mode of preservation, differ a little in appearance from the latter. The record of this species from the Lower Greensand of Kent, given by Morris, is apparently erroneous.

Types.—The types of both *Arca carinata* and *Cucullæa costellata* are in the British Museum.

Distribution.—Greensand of Blackdown (zones viii to xii, especially x) and Haldon. Upper Greensand of Devizes and Ventnor. Gault of Black Ven. Zones of *Acanthoceras mammilatum* and *Hoplites interruptus* at Okeford Fitzpaine. Gault (zones i, ii, viii—x) of Folkestone. Chalk Marl (zone of *Schloenbachia varians*) of Ventnor and Folkestone.

Genus—Trigonoarca, *T. A. Conrad*, 1863.

['Proc. Acad. Nat. Sci. Philad.' (1862), 1863, p. 289; ibid., 1872, p. 54; 'Amer. Journ. Conch.,' vol. iii (1867), p. 9; Appendix to W. C. Kerr's 'Rep. Geol. Surv. N. Carolina, vol. i, 1875 (Raleigh); figured, 'Journ. Acad. Nat. Sci. Philad.,' ser. 2, vol. iv (1860), p. 281, pl. xlvii, fig. 20.]

Trigonoarca Passyana (*d'Orbigny*), 1844. Plate VIII, figs. 9 *a*—*c*, 10 *a*, *b*.

1832. Cucullea carinata, *A. Passy* (non *Sowerby*). Descript. Géolog. de la Seine-Infér., p. 8 (of expl. of plates), pl. xiv, figs. 11, 12.
1844. Arca Passyana, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p 241, pl. cccxxvii, figs. 1, 2.
1850. — — — Prodr. de Pal., vol. ii, p. 164.
1866. — — *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 475.
1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca*).
1896. — ligeriensis, *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 153 (from Chard).
? 1897. Cucullæa Passyana, *R. Leonhard.* Die Fauna der Kreidef. in Oberschles. (Palæontographica, vol. xliv), p. 51.

Description.—Shell oblong, more or less elongate, convex, inequilateral, rather short anteriorly. Ventral margin nearly straight, placed a little obliquely;

anterior margin rounded; posterior nearly straight and very oblique, forming an acute angle with the ventral margin. Umbones rather prominent, with a carina which extends to the postero-ventral angle, and cuts off a depressed postero-dorsal area. Ornamentation consists of very fine radial ribs. Hinge a little curved; teeth numerous, gradually becoming larger and more oblique toward the extremities.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	58	50	37	57	62	48	mm.
Height	45	37	27	39	39	33	,,
Thickness	48	35	—	39	39	30	,,

(1) From the Chloritic Marl, Warminster. (2) From the base of the Chalk Marl, Chard. (3) From the Upper Greensand, Kingskerswell. (4—6) From the Cenomanian, Rouen.

Affinities.—This species is very similar to *Trigonoarca ligeriensis* (d'Orbigny),[1] with which it may prove to be identical; that form is said to be distinguished by its greater convexity and more widely separated umbones.

It appears also to be related to d'Orbigny's *Arca royana*,[2] but that form is only known by its cast.

Remarks.—This species was founded on internal casts from the Cenomanian of Rouen. The only specimen I have seen with the shell preserved is a silicified example from the Greensand of Kingskerswell (British Museum, No. L 1853); an internal mould from the same locality and collection shows the character of the hinge. The internal casts from various localities agree perfectly with specimens obtained from Rouen.

Types.—Some specimens from Rouen, but apparently not the type, are in the d'Orbigny Collection.

Distribution.—Base of the Lower Chalk (zone of *Schlœnbachia varians*) of Chard. Chloritic Marl of Maiden Bradley, Urchfont (near Devizes) and Warminster. Upper Greensand of Kingskerswell.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 227, pl. cccxvii, figs. 1—3 (*not* 4, 5).

[2] Ibid., p. 243, pl. cccxxvii, figs. 3, 4.

Genus—Cucullæa, *Lamarck*, 1801.

['Syst. Anim. sans Vert.,' p. 116.]

1. *Lower Cretaceous Species.*

Cucullæa Forbesi (*Pictet and Campiche*), 1866. Plate IX.

1845. Arca exaltata (?), *E. Forbes* (non *Nilsson*). Quart. Journ. Geol. Soc., vol. i, p. 245, pl. iii, fig. 5.
1850. — gabrielis, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 80 (*partim*).
1854. Cucullæa gabrielis, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 197.
1866. Arca Forbesi, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 471.

Description.—Shell stout, much inflated, regularly convex, trapezoidal, inequilateral. Anterior margin shorter than the posterior, and forming with the hinge-line about a right angle. Ventral margin slightly curved, or in part nearly straight, sloping posteriorly. Posterior margin nearly straight, oblique, forming with the hinge-line an obtuse angle, and with the ventral margin a rounded acute angle, which is usually the most ventral part of the shell. Umbones prominent, incurved, pointed, widely separated, with a sharply defined carina extending to the postero-ventral angle, and cutting off a flattened postero-dorsal area, which is sharply bent with regard to the rest of the valve. Hinge-area very large, with numerous close-set ligament-grooves; margins curved, bounded by a ridge. Ornamentation consists of many slender, sharp, radial ribs, separated by relatively broad and shallow grooves, which are crossed at regular intervals by fine concentric ribs. On the anterior part of the shell the radial ribs become more prominent and less numerous. On the postero-dorsal area, except near the umbo, the radial ribs are much less distinct than elsewhere, but numerous radial striæ crossed by lines of growth are seen. Hinge-line long, sometimes five-sixths of the length of the shell. Central teeth numerous, perpendicular; lateral teeth few, and parallel to the hinge-margin.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	86	79	72	63	63	mm.
Height	77	76	60	65	58	,,
Thickness	80	95	71	70	72	,,

Affinities.—*Cucullæa Forbesi* is closely related to *C. Gabrielis*, Leymerie,[1] but differs from it in the presence of strong radial ribs on the adult shell. In *C. Gabrielis* (of which I have seen three or four very perfect specimens) these ribs are found on the young parts only, and are but faintly marked. *Cucullæa tumida*, Matheron, is perhaps related to *C. Forbesi;* it was founded on an internal cast. *C. Forbesi* is distinguished from *Arca Moreana*, d'Orbigny,[2] by its strong carina and more widely separated umbones.

The form figured by Coquand[3] as *Arca dilatata* (from the Aptian of Obon, Arcaïne, &c.) is very near to *C. Forbesi;* but the shell is longer posteriorly, and the radial ribs are not seen. *A. Gresslyi*, de Loriol,[4] is, perhaps, closely allied to *C. Forbesi*, but is at present imperfectly known.

Types.—From Atherfield. I have not seen the original of Forbes' figure (1845).

Distribution.—*Perna*-bed of Atherfield. Also, according to Fitton, in Beds iii, vi, ix, and xiii of Atherfield.

CUCULLÆA CORNUELIANA (*d'Orbigny*), 1844. Plate VIII, figs. 11—13; Plate X, figs. 1 *a*—*c*, 2 *a*, *b*, 3.

1844.	ARCA CORNUELIANA, *A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 208, pl. cccxi, figs. 1—3.
1845.	—	—	*E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 246.
1850.	—	—	*A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 80.
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 185.
1855.	—	—	*G. Cotteau.* Moll. Foss. de l'Yonne, p. 86.
1861.	—	—	*P. de Loriol.* Anim. Invert. Foss. du Mont Salève, p. 86, pl. x, fig. 7.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 445, 469.
1867.	—	—	*P. de Loriol.* In *A. Favre,* Recherch. géol. dans Savoie, &c., vol. i, p. 380, pl. c, fig. 9.
1871.	—	—	*F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 342 (*? Trigonoarca*).
? 1883.	CUCULLÆA SUBNANA, *W. Keeping.*		Foss., &c., Upware and Brickhill, p. 115 pl. v, fig. 10.

[1] 'Mém. Soc. Géol. de France,' vol. v (1842), p. 6, pl. vii, fig. 5; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 198, pl. cccviii.

[2] D'Orbigny, ibid., p. 200, pl. cccix, figs. 1—3.

[3] 'Mon. de l'étage Aptien de l'Espagne' (1865), p. 139, pl. xxii, figs. 1, 2.

[4] 'Anim. Invert. foss. Néoc. du Mt. Salève' (1861), p. 87, pl. xi, figs. 1—3.

1898. Cucullæa (Idonearca) Cornueliana, *E. G. Skeat and V. Madsen.* Danmarks geol. Undersog., vol. ii, p. 167, pl. vi, fig. 5.

? Non 1846. Arca (Cucullæa) Cornueliana, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 13.

Description.—Shell more or less oblong, convex, a little inequilateral. Anterior border forming an angle (90° or more) with the hinge-line, gradually curving toward the ventral border. Ventral border curved. Posterior border nearly straight, oblique, forming a rounded angle with the curved ventral border. Umbones of moderate size, close together; no distinct carina, but the shell is sharply bent along a line passing from the umbo to the postero-ventral angle; this flattened part is divided into two nearly equal parts by a narrow carina passing from the umbo posteriorly; on the right valve the carina is thread-like and crenulated; on the left valve it is less sharply defined. Area small, narrow. Ornamentation consists of numerous fine concentric ribs or striæ, and radial ribs usually less distinct than the concentric, but well marked anteriorly. Hinge-line relatively long. Central teeth transverse; lateral teeth parallel to the hinge-margin, striated.

Measurements:

	(1)	(2)	(3)	(4)	
Length	27	25·5	38	28	mm.
Height	22	21	32	25	,,
Thickness	19	20	—	—	,,

Affinities.—This species is closely related to *C. glabra*, Parkinson (see p. 57), but it never attains such large size, and its average is much smaller. It varies considerably in the proportion of length to height; in some cases the valves are only a little longer than high—in this respect differing from the type. Many forms are proportionately longer than is ever the case with *C. glabra*. The umbones are less prominent and less pointed than in the latter species. *Arca Robinaldina*, d'Orbigny, differs from this species in possessing a sharply defined carina, &c.

I am inclined to think that the three specimens from Upware (preserved in the Woodwardian Museum), which were referred by W. Keeping (*vide supra*) to *C. subnana*, Pictet and Roux, belong to *C. Cornueliana*.

Types.—I did not find the types in the d'Orbigny Collection.

Distribution.—Crackers and Lower *Crioceras* Group of Atherfield. Bed xiv of Blackgang Chine (*fide* Fitton). Atherfield Beds of East Shalford. ? Lower Greensand of Upware.

CUCULLÆA FITTONI (*Pictet and Campiche*), 1866. Plate X, figs. 4 *a*—*d*, 5—7.

1857. ARCA ROBINALDINA, *F. J. Pictet and E. Renevier* (non *d'Orbigny*). Foss. Terr. Aptien, &c. (Matér. Pal. Suisse, ser. 1), p. 105, pl. xv, fig. 4.

1866. — FITTONI, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 455, 471.

1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*? Trigonoarca*).

Description.—Shell more or less oblong, rather inflated, equilateral or slightly inequilateral. Anterior margin evenly rounded, passing gradually into the ventral, which is parallel to the dorsal margin, but curves toward the postero-ventral angle. Posterior margin nearly straight, oblique. Umbones moderately large, nearly median, separated by only a small space, with a very sharp carina, curved, and passing to the postero-ventral angle. The postero-dorsal area is sharply depressed, and near its ventral third bears another carina. Hinge-line rather short; area small, with many ligament-grooves. Ornamentation consists of many fine concentric grooves, and on the antero-dorsal part of the shell of a few radial ribs; postero-dorsal area with many radial ribs. Central teeth (about ten) transverse; lateral teeth longitudinal. Interior not seen.

Measurements:

	(1)	(2)	
Length . . .	19·5	14	mm.
Height . . .	15	11·5	,,
Thickness . .	12·5	9·5	,,

Affinities.—This form is probably only a local variety of *Arca Robinaldina*, d'Orbigny; it differs from that in being less elongate posteriorly. In d'Orbigny's figure of *A. Robinaldina* the ventral margin has a greater curvature than in any of the specimens which I have seen in the Paris museums. *Arca Cornueliana*, d'Orbigny, is distinguished from *C. Fittoni* by the absence of the *sharp* carina. *Arca æquilateralis*, Briart and Cornet, is very similar to *C. Fittoni*, but it appears to be proportionately shorter, and to have the anterior margin less curved.

Distribution.—Crackers of Atherfield. Atherfield Beds of East Shalford.

CUCULLÆA VAGANS, *Keeping*, 1883. Plate X, figs. 8—10.

1883. CUCULLÆA VAGANS, *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 151, pl. viii, fig. 8.

1883. — ERRANS, *Keeping*. Ibid., pp. 33, 34, 36, 65 (*nom. nud.*).

Description.—Shell rather stout, rounded, nearly equilateral. Anterior margin rounded; posterior a little truncated; ventral curved. Umbones prominent, incurved. Hinge-area relatively broad. Posterior part of shell sharply bent. Ornamentation consists of strong, equal, regular ribs, separated by broader grooves; the grooves are crossed at regular intervals by fine concentric ribs. Central teeth transverse; lateral parallel to the hinge-line. Margins of valves coarsely toothed.

Measurements:

Length	20 mm.
Height	18 ,,

Remarks.—This form, which at present is only known by a few rather imperfect specimens, appears to be clearly distinguished by the character of its ornamentation.

Cucullæa errans, Keeping, *nom. nud.*, I think undoubtedly refers to this species; the name was used in the earlier part of Keeping's work (*vide supra*), and the remarks there made concerning it agree perfectly with those given later in connection with *C. vagans*. This view is further supported by the fact that on the back of the tablet which bears the type-specimens of *C. vagans* there is written in Keeping's handwriting "*C. errans*, W. K."

Types.—In the Woodwardian Museum, Cambridge.

Distribution.—Lower Greensand (black grit nodules) of Upware. ? Spilsby Sandstone of Spilsby.

Sub-genus—Dicranodonta, *s.-g. nov.*

Shell stout, subquadrate or rounded. Hinge-area broad. Hinge-plate large, curved; central teeth transverse; lateral teeth long, curved ventrally, nearly parallel, often bifurcating. No posterior adductor plate.

Type.—*Cucullæa donningtonensis*, Keeping (Pl. X, figs. 11—14; Pl. XI, fig. 1). Claxby Ironstone.

The form described by Keyserling,[1] and by F. Schmidt,[2] as *Pectunculus petschora* probably belongs to this sub-genus. The latter author was inclined to regard it as the type of a new genus.

[1] 'Reise in das Petschora-land' (1846), p. 306, pl. xvii, figs. 5, 6.

[2] "Resultate der Mammuthexpedit.," 'Mém. Acad. Imp. Sci. St. Pétersbourg,' ser. 7, vol. xviii, No. 1 (1872), p. 151, pl. i, fig. 14; pl. iii *a*, fig. 17.

CUCULLÆA (DICRANODONTA) DONNINGTONENSIS, *Keeping*, 1883. Plate X, figs. 11 *a*—*c*, 12—14; Plate XI, figs. 1 *a*, *b*, 2.

1883. CUCULLÆA DONNINGTONENSIS, *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 152, pl. viii, fig. 9.

Description.—Shell stout, subquadrate, rounded, a little inequilateral, rather convex. Anterior margin rounded, uniting with the ventral in a regular curve. Ventral margin nearly parallel to the dorsal. Posterior truncated, slightly oblique, more or less curved, and forming with the ventral border a rounded angle usually a little less than a right angle. Umbones prominent, pointed, well separated; no distinct carina, but behind a line drawn from the umbo to the postero-ventral angle the shell is sharply compressed. Anteriorly the shell is gently compressed. Hinge-area broad, shorter than the length of the shell, usually three-fifths to four-fifths of the latter; ligament-grooves numerous, close-set, very regular.

Ornamentation consists of well-marked but slightly elevated radial ribs, which are less distinct on the posterior slope of the shell; between these ribs are from two to five smaller ribs; lines of growth, usually faintly marked, occur at intervals. Hinge-plate large, extending ventrally along the anterior and posterior margins of the shell; central teeth small, transverse, becoming a little oblique laterally; lateral teeth long, usually three or four at each end, curved ventrally so as to be nearly parallel to the *inner* border of the hinge-plate, and usually bifurcating. No posterior adductor plate. Margins coarsely crenulate.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	52	51	48	41	35	19	mm.
Height	49	49	45	38	30	16	,,
Thickness	48	42	36	32	25	12	,,

Affinities.—This species appears to be closely allied to *Arca Sablieri*,[1] Coquand, from the Aptian of Josa, Obon, and Arcaïne (Spain), but that form, so far as I am able to tell from the figures and description, differs in the shell being higher and shorter, and in having a trellis-like ornamentation. Coquand refers the specimen figured by Vilanova[2] as *Arca fibrosa*, d'Orbigny, to *A. Sablieri*, but Vilanova's figure appears to represent quite a different form.

Remarks.—This species was founded by Keeping on an external mould in a black grit nodule from the Lower Greensand of Upware, and that author con-

[1] 'Mon. de l'étage Aptien de l'Espagne' (1865), p. 137, pl. xiv, figs. 7, 8.

[2] J. Vilanova y Piera, 'Mem. geog.-agric. de Castellon' (1858), pl. ii, fig. 13.

sidered that the form which is abundant at Donnington[1] was distinct. After a careful comparison of a larger series of the latter with the type-specimen I am unable to see any real difference. The figure given by Keeping is not quite accurate in outline, and is drawn from a gutta-percha cast; the mould itself is not perfect at the anterior and ventral margins, and near the umbo a portion of the shell remains in it.

Types.—In the Woodwardian Museum, Cambridge, from Upware.

Distribution.—Lower Greensand (black grit nodules) of Upware. Claxby Ironstone (zone of *Bel. lateralis*) of Benniworth Haven, near Donnington. Spilsby Sandstone of Donnington.

Cucullæa (Dicranodonta ?) obliqua (*Keeping*), 1883. Plate XI, figs. 3 *a*—*c*, 4.

1883. Pectunculus obliquus, *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 116, pl. vi, fig. 1.

Non 1826. — — *Defrance*. Dict. Sci. Nat., vol. xxxix, p. 224.
— 1833. — obliqua, *J. Lea*. Contrib. Geol., p. 78, pl. iii, fig. 57.
— 1835. — obliquus, *G. Münster*. Neues Jahrb. für Min., &c., p. 438.
— 1843. — — *L. Reeve*. Conch. Icon., vol. i, pl. vi, fig. 33.

Description.—Shell stout, ovate-oblong, inequilateral, moderately convex but flattened centrally. Anterior border rounded, ventral slightly curved, posterior oblique and slightly curved—forming with the ventral a blunt angle. Shell compressed dorsal to a line from the umbo to the postero-ventral angle. Umbones small, rather close together. Hinge-line short. Hinge-area narrow, with many ligament-grooves. Surface of shell with fine radial striæ and a few fairly well-marked lines of growth. Central teeth few, small; the laterals (two or three) long, the first parallel to the hinge-margin, but the last curving ventrally.

Measurements:

	(1)	(2)	
Length	16	20	mm.
Height	13	17·75	,,
Thickness	10	—	,,

Affinities.—This form was referred by Keeping to *Pectunculus*, but the character of the teeth show that it cannot be placed in that genus. The concluding remark of the author mentioned ("It approaches nearest to some Jurassic species from the Great Oolite and Coral Rag") seems to show that he was really thinking of *Cucullæa* rather than *Pectunculus*. The fact that the lateral teeth (or some of

[1] Erroneously spelt Do*dd*ington by Keeping ('Foss. Upware,' &c.), p. 153.

them) curve ventrally, and also the form of the shell, seem to connect this species with *C. donningtonensis*, Keeping (*vide supra*, p. 54).

Remarks.—The specific name given by Keeping is preoccupied as shown above, but, since the species is now removed from *Pectunculus*, the specific name can be retained.

Types.—The only specimens seen are the types (three in number) from Upware, preserved in the Woodwardian Museum, Cambridge.

Distribution.—Lower Greensand of Upware.

2. *Upper Cretaceous Species.*

CUCULLÆA VENUSTA, *Nyst*, 1848. Plate XI, figs. 5 *a*—*c*, 6 *a*, *b*, 7 *a*, *b*.

1836. CUCULLÆA FORMOSA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 7.

1848. ARCA (CUCULLÆA) VENUSTA, *H. P. Nyst*. Tableau des Espèces vivant et foss. des Arcacées (Mém. Acad. Roy. Belg., vol. xxii), p. 76 (*nom. mut.*).

1850. — SUBFORMOSA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 164 (*nom. mut.*).

1854. CUCULLÆA FORMOSA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 197.

1866. ARCA (CUCULLÆA) FORMOSA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. iii, p. 473.

? 1868. — SUBFORMOSA, *A. Briart and F. L. Cornet*. Descript. de la Meule de Bracquegnies (Mém. Cour. et des Sav. étrangers, Acad. Roy. Belg., vol. xxxiv), p. 54, pl. v, figs. 11, 12.

1871. — FORMOSA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*? Trigonoarca*).

Non 1833. CUCULLÆA FORMOSA, *G. B. Sowerby*. Proc. Zool. Soc., pt. i, p. 20. (Figured Reeve, Conch. Icon., vol. ii, 1844, pl. ii, fig. 10.)

Measurements:

	(1)	(2)	(3)
Length	8	7	4 mm.
Height	6·5	5·5	3 ,,

Remarks.—I have seen only five specimens of this form—three in the Bristol Museum and two belonging to Mr. Meyer. The shell is not well preserved in any case. In form, and the character of the concentric ornamentation, it is near to *C. Fittoni* (see p. 52), but all five specimens are much smaller.

C. venusta appears to differ from *C. Fittoni* in being more convex; in having the ventral margin less curved posteriorly—so that the postero-ventral angle is

more acute; and the carina is perhaps less sharp. The inner carina and also the *anterior* radial ribs seem to be wanting in *C. venusta*.

The specimen figured by Briart and Cornet from the Meule de Bracquegnies is much more pointed posteriorly than the Blackdown examples.

Type.—Bristol Museum.

Distribution.—Blackdown Greensand.

CUCULLÆA GLABRA, *Parkinson*, 1811. Plate XI, figs. 8 *a*—*c*, 9 *a*, *b*, 10—12; Plate XII, figs. 1 *a*, *b*, 2, 3 *a*, *b*, 4, 5.

1811. CUCULLÆA GLABRA, *J. Parkinson*. Org. Remains, vol. iii, p. 171.
1814. — — *J. Sowerby*. Min. Conch., vol. i, pl. lxvii, p. 151.
1818. — FIBROSA, *Sowerby*. Ibid., vol. iii, p. 9, pl. ccvii, fig. 2.
1818. — CARINATA, *Sowerby*. Ibid., vol. iii, p. 9, pl. ccvii, fig. 1.
1837. ARCA GLABRA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 149 (*partim*), pl. cxxiv, figs. 1 *a*, *b* (? 1 *c*).
1844. — FIBROSA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 212, pl. cccxii.
1850. — — — Prodr. de Pal., vol. ii, p. 138.
1852. — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès Verts de Genève, p. 463, pl. xxxvii, fig. 2.
1854. CUCULLÆA GLABRA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 197.
1854. — FIBROSA, *Morris*. Ibid., p. 197.
1855. ARCA FIBROSA, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 88.
1857. — GLABRA, *F. J. Pictet and E. Renevier*. Foss. du Terr. Aptien de la Perte du Rhône, &c. (Matér. Pal. Suisse, ser. 1), p. 104.
1862. IDONEARCA FIBROSA, *T. A. Conrad*. Proc. Acad. Nat. Sci. Philad. for 1863, p. 289.
1866. ARCA GLABRA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 456, 473.
1868. — — *A. Briart and F. L. Cornet*. Descript. de la Meule de Bracquegnies (Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg., vol. xxxiv), p. 55, pl. v, figs. 1—6.
1872. IDONEARCA GLABRA et I. FIBROSA, *T. A. Conrad*. Proc. Acad. Nat. Sci. Philad., p. 54.
1875. ARCA GLABRA, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 2, pl. xlix, fig. 2 (*non* figs. 1, 3).

Non 1832. CUCULLÆA GLABRA, *A. Passy*. Descript. géol. de la Seine-Inférieure, p. 8 (of explanation of plates), pl. xiv, fig. 10.
— 1832. — CARINATA, *Passy*. Ibid., p. 8, pl. xiv, figs. 11, 12.
? — 1837. ARCA CARINATA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 150, pl. cxxiv, fig. 2.
? — 1840. CUCULLÆA GLABRA, *H. B. Geinitz*. Char. der Schichten und Petrefacten des sachsisch. Kreidegeb., pt. 2, p. 49.

Non 1842. Cucullæa glabra, *P. Matheron*. Catal. méthod. et descript. des Corps foss. du Bouches-du-Rhone, p. 161.
— 1843. — — *H. B. Geinitz*. Die Verstein. von Keislingswalda, p. 14, pl. iii, figs. 4—7.
? — 1846. Arca (Cucullæa) glabra, *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 13, pl. xxxiv, fig. 44; pl. xxxv, figs. 1, 2.
— 1847. — glabra, *J. Müller*. Petref. der Aachen. Kriedeformat., pt. 1, p. 18.
— 1847. Cucullæa glabra, *Müller*. Ibid., p. 19.
— 1858. Arca fibrosa, *J. Vilanova y Piera*. Mem. geog.-agric. de Castillon, pl. ii, fig. 13.
? — 1863. Cucullæa glabra, *R. Drescher*. Zeit. d. deutsch. geol. Gesellsch., vol. xv, p. 349.
? — 1875. Arca glabra, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 221, pl. xlix, figs. 1, 3.
? — 1881. — fibrosa, *J. Kiesow*. Schrift. d. nat. Gesellsch. Danzig, N. F., vol. v, p. 410.
? — 1885. Cucullæa glabra, *F. Nötling*. Die Fauna der baltisch. Cenomangeschiebe (Palæont. Abhandl., vol. ii), p. 25.
? — 1897. — (Idonearca) glabra, *R. Leonhard*. Die Fauna der Kreideformat. in Oberschlesien. (Palæontographica, vol. xliv), pp. 21, 51.

Description.—Shell subrhomboidal or more or less oval, a little inequilateral and oblique; high, convex. Anterior margin curved, passing gradually into the ventral margin, and joining the hinge-line at a slightly obtuse angle. Posterior margin nearly straight, oblique, forming with the hinge-line an obtuse angle, and with the ventral margin an acute angle more or less rounded. Umbones large, with a rounded but usually well-marked carina extending from each to the postero-ventral angle of the valves. Sometimes a thread-like ridge, crenulated, passes from the umbo of the right valve to the middle of the posterior margin. Hinge-area long, but comparatively narrow; with three or four, sometimes more, ligament-grooves on each side. Ornamentation consists of numerous radial ribs, sometimes raised and somewhat granular, crossed by concentric growth-lines. Hinge-line long, with from five to eight central transverse teeth, and three or four long lateral teeth, placed parallel or nearly parallel to the hinge-line, and striated. Posterior adductor plate large. Anterior adductor impression smaller. Margins of valves entire.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	74	55	47	37·5	36	22	21	mm.
Height	61	51	41	35·5	30·5	21	21	,,
Thickness . . .	62	46	40	28	31	21	15	,,
Hinge-line . . .	60	44	35	27	29·5	17	16	,,

Affinities.—The forms described by Sowerby under the names *Cucullæa glabra*

and *C. fibrosa* have been considered by Briart and Cornet, Pictet and Campiche, Pictet and Renevier, Downes, and others, to belong to the same species. Sowerby's *glabra* was a more rhomboidal example than his *fibrosa*, but a large series of specimens shows that there is no essential difference between the two.

One of the specimens figured by Goldfuss (fig. 1 *c*) as *Arca glabra* (Sowerby) was regarded by d'Orbigny as distinct from the others (figs. 1 *a*, *b*, *d*), and named[1] by him *Arca subglabra*. This name has been since generally adopted for the form found in the Aachen Greensand (Senonian). Goldfuss does not state from whence his *figured* specimens came, but gives in the text, as localities of the species, Quedlinburg, Coesfeld, Aachen, Kelheim, and Blackdown. J. Böhm[2] found, in the Museum of the Schloss Popplesdorf, examples labelled "England" which agree well with Goldfuss' figures, and he believes that the figured specimens really came from Blackdown, and are the true *Cucullæa glabra*, Sowerby. Briart and Cornet[3] also regard Goldfuss' *glabra* as identical with Sowerby's. The Blackdown specimens of *C. glabra*, Sowerby, certainly agree closely with the figures of Goldfuss (except fig. 1 *c*, in which the lateral teeth are not parallel to the hinge-margin, but this may have been a worn specimen); specimens and figures both differ considerably from the figures of the undoubted Aachen form given by Holzapfel;[4] the last-named author, however, does not appear to accept Böhm's view, but takes the *glabra* of Goldfuss as the type of *Arca subglabra*, d'Orbigny.

Judging from Holzapfel's figures and description, *Cucullæa subglabra* of the Aachen Greensand differs from *C. glabra*, Sowerby, in the shell being more convex and relatively higher; the hinge-line relatively shorter; the lateral teeth shorter, somewhat curved and not quite parallel to the hinge-line; the absence or indistinct nature of the radial ribs; and perhaps also in the less distinct carina.

The arrangement of the teeth in *C. glabra* is similar to that in *C. Mülleri*, Holzapfel,[5] from the Aachen Greensand; but in that form the shell is more rounded than in *C. glabra*, it is without a keel, the area is smaller, the hinge-line shorter, &c.

C. Mailleana (d'Orbigny) (see p. 63) is relatively longer, more oblique—owing to the greater proportionate length of the posterior margin, and is ornamented with well-marked concentric grooves, the radial ribs being absent or indistinct.

[1] 'Prodr. de Pal.,' vol. ii (1850), p. 244.

[2] "Der Grünsand von Aachen und seine Molluskenfauna," 'Verhandl. des naturh. Vereines der preussisch. Rheinl.,' &c., vol. xliv (1885), p. 92.

[3] "Descript. de la Meule de Bracquegnies," 'Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg.,' vol. xxxiv (1868), p. 55.

[4] "Die Mollusken der Aachener Kreide" ('Palæontographica,' vol. xxxv, 1889), p. 206, pl. xxii, figs. 3, 5.

[5] Ibid., vol. xxv (1889), p. 209, pl. xxiii, fig. 1.

C. Marreana (d'Orbigny), from the Cenomanian of Mans, is more oval in outline, the area and hinge-line are relatively shorter, and the surface of the shell is smoother than in *C. glabra*, Sowerby.

According to Geinitz *C. glabra* occurs in the Lower Quadersandstone (Cenomanian) of Koschütz, Neiderschöna, and Goldenen Höhe (Saxony). All the specimens obtained are apparently internal casts, so that comparison is very difficult, but they appear to be relatively longer and more oblique than *C. glabra*, Sowerby, and the umbo is sharper than in wax casts taken from Blackdown specimens. The same remarks apply to the Bohemian form referred by Reuss to this species.

Cucullæa (*Idonearca*) *Shumardi*, Meek and Hayden,[1] from the Fox Hill Group of Upper Missouri, appears to be very closely related to *C. glabra*, but without seeing specimens I am unable to state whether it is really distinct or not.

Remarks.—This is one of the commonest fossils in the Blackdown Greensand. In old specimens the radial ribs usually become obliterated, and the shell is then nearly smooth save for lines of growth. The appearance of the ornamentation varies considerably according to the state of preservation of the shell. In old forms the shell becomes, as a rule, relatively longer, more convex, and more oblique. Before the adult state is reached the lateral teeth are placed obliquely to the hinge-line (Pl. XI, figs. 10, 11). Two forms of this "species" may be recognised:—(i) in which the shell is rhomboidal in outline, rather compressed, and with a sharp carina (Pl. XII, figs. 3, 4); (ii) in which the shell is of more rounded outline, more inflated, and has only an indistinct carina (Pl. XI, fig. 8). These two types can be seen in various stages of growth, but there are also some examples which seem to be intermediate in character.

Types.—I have not seen the type, but the specimens figured by Sowerby as *C. glabra*, *C. fibrosa*, and *C. carinata* (all from Blackdown) are in the British Museum.

Distribution.—Blackdown Greensand (especially zone x). Gault of Folkestone.

[1] 'Proc. Acad. Nat. Sci. Philad.,' vol. viii (1856), p. 86; Meek, 'Invert. Cret. and Tert. Foss. U. Missouri' ('Rep. U.S. Geol. Surv. Territ.,' vol. ix, 1876), p. 86, pl. xxviii, figs. 15 *a*—*g*; pl. xxix, fig. 4.

CUCULLÆA OBESA (*Pictet and Roux*), 1852. Plate XII, figs. 6, 7 *a*, *b*, 8 *a*, *b*.

1852. ARCA OBESA, *F. J. Pictet and W. Roux* (non *Sowerby*). Moll. Foss. Grès verts de Genève, p. 464, pl. xxxviii, figs. 1, 2.

1866. — — *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 459.

1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca ?*).

Non 1833. ARCA OBESA, *G. B. Sowerby.* Proc. Zool. Soc., pt. 1, p. 21 (figured *Reeve*, Conch. Iconica, vol. ii, 1843, pl. i, fig. 3).

Description.—Shell subrhomboidal, rounded, a little inequilateral and oblique, much inflated. Posterior border slightly convex, forming an obtuse angle with the hinge-line, and joining the ventral border at an acute but rounded angle. Umbones prominent, well separated except in young forms. A prominent but rounded carina extends from the umbo to the postero-ventral angle. Hinge-area long, of moderate breadth, with numerous (often thirteen to eighteen) closely-set ligament-grooves. Ornamentation consists of faintly marked radial ribs crossed by lines of growth. Hinge with some central transverse teeth, and lateral teeth which are parallel or nearly parallel to the hinge-line. Posterior adductor plate well marked.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	53	47	43	28	22	mm.
Height	48	42·5	40	25·5	18	,,
Thickness . . .	52	44	37	21	17	,,
Hinge-line . . .	39	31	26	15	14	,,

Affinities.—This is related to *C. glabra*, Sowerby, but can be distinguished from that by its more inflated form, more prominent umbones, more rounded outline; the ventral margin is placed more obliquely with regard to the hinge-line; the hinge-line is relatively shorter and the ligament-grooves more numerous; the radial ribs are less distinctly marked.

Remarks.—The name *Arca obesa* was pre-occupied by Sowerby for a recent species dredged near the coast of West Columbia; but since the fossil form is now referred to the genus *Cucullæa* the specific name may be retained.

Types.—The types are from the Gault of the Perte du Rhône.

Distribution.—Gault of Folkestone (zones viii, ix); and Aylesford. Cambridge Greensand (derived). Chloritic Marl of the Isle of Wight and Warminster. Upper Greensand of Devizes.

CUCULLÆA NANA, *Leymerie*, 1842. Plate XIII, figs. 1 *a*—*e*, 2, 3.

1842. CUCULLÆA NANA, *A. Leymerie.* Mém. Soc. Géol. de France, vol. v, p. 7, pl. ix, figs. 1 *a*—*d*.
1844. ARCA NANA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 210, pl. cccxi, figs. 8—12.
1850. — — — Prodr. de Pal., vol. ii, p. 138.
1866. — — *F. J. Pictet and G. Campiche.* Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 472.

Description.—Shell rhomboidal, inflated, inequilateral. Anterior margin forming about a right angle with the dorsal, and curving ventrally. Ventral margin nearly parallel to the dorsal, slightly curved. Posterior margin slightly convex or sinuous, a little oblique. Umbones of moderate size, curving forwards, more or less well separated, placed near the anterior third, with a carina extending to the postero-ventral angle; postero-dorsal area concave, but slightly raised near the middle. Hinge-area long, broadest just in front of the umbones; inner part raised in front, with a parallel-sided groove and ridge on each side; ligament-grooves numerous. Ornamentation consists of numerous slightly elevated concentric ribs, crossed by narrower radial ribs; at the anterior end of the shell some of the radial ribs at intervals are more elevated and serrate. Hinge not seen.

Measurements:

	(1)	(2)	(3)	(4)	
Length . . .	15	12·5	12	9·5	mm.
Height	11	9	9	6·75	,,
Thickness . . .	11·5	8	9	7	,,

Affinities.—This species is closely allied to *Cucullæa subnana*, Pictet and Roux, but appears to differ in the form of the area, which is widest just in front of the umbones, and tapers much more rapidly anteriorly than posteriorly.

Remarks.—In many English specimens the area is wider and the umbones more distant than in the example figured by d'Orbigny; but others agree exactly with his figure, and a series of specimens shows a gradual transition from forms with a comparatively narrow area to those with a wide area.

Types.—Specimens, but probably not those figured, are in the d'Orbigny collection.

Distribution.—Gault (zones ii, vii, viii, ix, and x) of Folkestone. Cambridge Greensand (derived).

CUCULLÆA MAILLEANA (*d'Orbigny*), 1844. Plate XIII, figs. 4 *a*—*c*, 5 *a*, *b*.

1832.	CUCULLÆA GLABRA,	*A. Passy* (non *Sowerby*).	Géol. de la Seine-Infér., p. 8 (of expl. of plates), pl. xiv, fig. 10.
1844.	ARCA MAILLEANA,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 229, pl. cccxviii, figs. 3—7.
1850.	—	—	Prodr. de Pal., vol. ii, p. 164.
? 1852.	—	*R. Kner.*	Denkschr. d. k. Akad. Wissensch. Math.-nat. Sc., vol. iii, p. 313, pl. xvii, fig. 25.
1866.	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 475.
1871.	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca*).

Description.—Shell oval or rhomboidal, convex, oblique, highest posteriorly. Anterior margin gently curved, relatively short. Posterior margin rather long, oblique, slightly curved. Ventral margin with a considerable slope posteriorly, forming an acute, but rounded, angle with the posterior margin. Umbones rather small, with a carina extending to the postero-ventral angle. A curved ridge passes from the umbo to just above the middle of the posterior side. Hinge-area rather narrow. Ornamentation consists of well-marked concentric grooves, with faint radial ribs on the posterior and anterior portions of the shell. Lateral teeth parallel to the hinge-line.

Measurements:

	(1)	(2)
Length . . .	26 . .	25 mm.
Height . . .	22·5 . .	21 ,,
Thickness . . .	18·5 . .	18 ,,

Affinities.—This species can be distinguished from *C. glabra*, Sowerby, by the great obliquity of the ventral margin of the shell, the shorter area, and the much less distinct radial, and better-marked concentric, ornamentation.

The larger forms of *C. obesa* are readily distinguished from *C. Mailleana*; in the smaller the outline of the shell is more rounded, the posterior angle is less sharp, the carina more rounded, and the concentric grooves less distinct than in *Mailleana*. D'Orbigny compares this species with *C. Cornueliana*, but in that form the ventral margin is more nearly parallel to the hinge-line.

In form, some examples of *C. Mailleana* resemble *Arca Dumortieri*, d'Archiac,[1] but the character of the ornamentation appears to be different.

[1] 'Bull. Soc. Géol. de France,' ser. 2, vol. xi (1854), p. 213, pl. xi, figs. 8, 8 *a*—*d*.

Remarks.—Most of the English specimens have only a portion of the shell preserved. I have collected examples from the Cenomanian of St. Catherine, near Rouen (the locality of the types), which agree exactly with English specimens.

Types.—Specimens from Rouen, but not the types, are in the d'Orbigny Collection at the Museum of Natural History, Paris.

Distribution.—Chalk Marl of Pinhay Cliff, Lyme Regis. Base of Chalk Marl (zone of *Schlœnbachia varians*) of Chard, Maiden Newton, Eggardon Hill, and Titherleigh near Chard. Chloritic Marl of Maiden Bradley. Rye Hill Sand of Warminster. Upper Greensand of Plush.

CUCULLÆA, sp. Plate XIII, figs. 6 *a*, *b*, *c*.

Cf.	1844.	ARCA GUERANGERI,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 228, pl. cccxviii, figs. 1, 2.
—	1850.	—	—	Prodr. de Pal., vol. ii, p. 164.
—	1866.	—	*F. J. Pictet and G. Campiche.*	Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 474.
—	1871.	—	*F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca*).

Description.—Shell oval or rhomboidal, high, convex. Anterior and ventral margins curved. Posterior margin oblique; postero-ventral angle rounded; antero-dorsal angle sharp. Umbones rather small, close together, placed near the anterior third of the shell. Carina rounded. Hinge-area narrow. Ornamentation consists of very fine radial ribs crossed by lines of growth.

Measurements:

Length	58 mm.
Height	47 „

Remarks.—The only example I have seen of this is a right valve in Mr. Meÿer's collection. It is similar to *Arca Guerangeri*, d'Orbigny, but is less inflated. Only a small part of the hinge is seen.

Distribution.—Chalk Marl (Meÿer's Bed 10) of Dunscombe.

Genus—Isoarca, *G. Münster*, 1842.

['Neues Jahrb. für Min., &c.,' 1842, p. 98; 'Beitr. zur Petrefact.,' pt. vi, 1843, p. 81.]

Isoarca Agassizii, *Pictet and Roux*, 1852. Plate XIII, figs. 7 *a*, *b*.

1842. Ceromya crassicornis, *L. Agassiz*. Et. Crit. Moll. Foss., p. 36 (*partim*), pl. viii *f*, figs. 1—4 (*non* 5—10).
1850. Isocardia crassicornis, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 137 (*partim*).
1852. Isoarca Agassizii, *F. J. Pictet and W. Roux*. Moll. Foss. Grès Verts de Genève, p. 466, pl. xxxviii, fig. 3.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 3), p. 422.
1875. — — *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxi, p. 300, pl. xv, figs. 1—3.
1879. — cantabrigiensis [H. G. Seeley, MS.], *F. G. H. Price*. The Gault, p. 60 (*nom. nud.*).

The only examples which I have seen of this species are a few internal moulds found in the Cambridge Greensand (derived).

Isoarca obesa (*d'Orbigny*), 1844. Plate XIII, figs. 8 *a*—*c*.

1844. Nucula obesa, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 180, pl. cccix, figs. 10—14.
1846. Isocardia Orbignyana, *A. d'Archiac*. Mém. Soc. Géol. France, ser. 2, vol. ii, p. 305, pl. xv, fig. 1.
1847. Nucula rhotomagensis, *d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 766.
1848. Arca isocardiæformis, *H. P. Nyst*. Tableau Espèces vivant et foss. des Arcacés, p. 38.
1850. Isoarca obesa, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 163.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 3), p. 423.

Non 1837. Nucula obesa, *A. Goldfuss*. Petref. Germ., vol. ii, p. 150, pl. cxxiv, fig. 4.

Description.—Shell oval or slightly subquadrate, rounded, length greater than height, much inflated, short anteriorly, long posteriorly; ventral margin slightly curved. Umbones large, anterior, close together, curved forward. Hinge-line about two-thirds the length of the shell. Hinge-area indistinctly limited, short anteriorly, elongate posteriorly. Ornamentation consists of numerous, very regular, closely-set, concentric grooves, with broader, flattish interspaces; and radial grooves which are less distinct than the concentric; the

whole forms a rectangular network, with pits at the intersection of the grooves. Teeth numerous. Margins of valves smooth.

Measurements:

	(1)	(2)	(3)
Length	25	20	15·5 mm.
Height	21·5	18	13 ,,
Thickness	21	17·5	11 ,,

(1) and (3) from Ball Wood. (2) from Maiden Bradley.

Types.—From the Cenomanian of Rouen.

Distribution.—Chloritic Marl of Ball Wood, near Plush, and of Maiden Bradley. Base of Chalk Marl (zone of *Schlœnbachia varians*) of Cerne, near Chard.

Genus—Pectunculus, *Lamarck*, 1799.[1]

['Mém. Soc. Hist. Nat. Paris,' p. 87.]

1. *Lower Cretaceous Species.*

Pectunculus marullensis, *Leymerie*, 1842. Plate XIII, figs. 9 *a*—*c*, 10.

1842.	Pectunculus marullensis,		*A. Leymerie.*	Mém. Soc. Géol. de France, vol. v, p. 7, pl. ix, fig. 2.
1844.	—	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 187, pl. cccvi, figs. 1—6.
1848.	—	marollensis,	*H. G. Bronn.*	Index Palæont., vol. i, p. 938.
1850.	—	marullensis,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 80.
? ? 1883.	—	—	*W. Keeping.*	Foss., &c., Upware and Brickhill, p. 116, pl. v, fig. 11.

Description.—Shell of moderate size, suboval or nearly orbicular, longer than high, rather convex, compressed antero-dorsally and postero-dorsally. Anterior margin rounded, posterior slightly subtruncate. Umbones of moderate size, close together, nearly median. Hinge-area small. Hinge with from four to six oblique teeth on each side. Ornamentation consists of numerous radial ribs, which bear finer ribs, and are crossed by fine concentric ribs.

Measurements:

	(1)	(2)
Length	12·5	11 mm.
Height	11	9·5 ,,

(1) and (2) from Shanklin.

[1] Dall considers that the name *Glycimeris*, Da Costa, should be adopted in place of *Pectunculus* or *Axinæa*. Until the necessity for this change has been definitely shown, I prefer to retain the name which has been in general use for the last hundred years. Dall, 'Trans. Wagner Free Inst. Sci. Philadelphia,' vol. ii, pt. iv (1898), pp. 571, 607. Cossman, 'Rev. Crit. Paléozool.' (1899), p. 66.

Affinities.—This is similar to *P. sublævis*, Sowerby, but is smaller, proportionately less convex, and with less prominent umbones.

Remarks.—Three specimens from the Lower Greensand of Upware, which were referred by Keeping (*vide supra*) to *Pectunculus marullensis* (and are preserved in the Woodwardian Museum), seem to differ from that species in having a subquadrate outline and more prominent umbones; the surface of the shell in those specimens is worn, and it is consequently impossible to compare satisfactorily the ornamentation. One example shows the hinge, but, unfortunately, very indistinctly; so far as I can see, the lateral teeth appear to be like those of *Cucullæa* rather than *Pectunculus*.

Types.—From the Neocomian of Marolles.

Distribution.—Ferruginous Sands (upper beds) of Shanklin.

2. *Upper Cretaceous Species.*

PECTUNCULUS SUBLÆVIS, *Sowerby*, 1824. Plate XIV, figs. 1 *a*—*c*, 2 *a*, *b*, 3 *a*—*d*, 4 *a*—*c*, 5 *a*—*c*, 6, 7.

1824.	PECTUNCULUS SUBLÆVIS,	*J. de C. Sowerby.*	Min. Conch., vol. v, p. 112, pl. cccclxxii, fig. 4.
1850.	—	—	*A. d'Orbigny*, Prodr. de Pal., vol. ii, p. 163 (*partim*).
1854.	—	—	*J. Morris.* Cat. Brit. Foss., ed. 2, p. 220.
1868.	—	—	*A. Briart and F. L. Cornet.* Descript. de la Meule de Bracquegnies (Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg. (vol. xxxiv), p. 61, pl. v, figs. 21—23.
? ? 1883.	—	—	*W. Keeping.* Foss., &c., Upware and Brickhill, p. 115, pl. v, fig. 9.
Non 1837.	—	—	*A. Goldfuss.* Petref. Germ., vol. ii, p. 160, pl. cxxvi, fig. 3.
— 1843.	—	—	*H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 14, pl. ii, figs. 19—21.
— 1846.	—	—	*A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. ii, p. 9, pl. xxxv, figs. 10, 11.
— 1847.	—	—	*J. Müller.* Mon. Petr. der Aachen. Kreidef., pt. i, p. 17.
? — 1883.	—	—	*H. Schröder.* Zeitschr. der Deutsch. geol. Gesellsch., vol. xxxiv, p. 274.

Description.—Shell stout, convex, longer anteriorly than posteriorly, but sometimes nearly equilateral; outline rounded or somewhat subquadrate; usually a little longer than high. Antero-dorsal part compressed, with a rounded

anterior border; posterior border subtruncate, dorsal part of it nearly straight; posterior extremity slightly angular. Umbones of moderate size. Hinge-line long. Hinge-area moderately broad, with many ligament-grooves. Ornamentation consists of broad radial ribs separated by narrow grooves—the main ribs bearing smaller ribs; this ornamentation is less distinctly marked antero-dorsally and postero-dorsally, the change in passing to the former area being gradual, to the latter rather sudden. At distant intervals there are lines of growth. Hinge-plate stout, with two or three small transverse teeth; and oblique, moderately long lateral teeth (usually six to nine). Adductor impressions well marked; the anterior subtrigonal, the posterior smaller and oval. Margins strongly crenulated.

Measurements:

	(1)	(2)	(3)	(4)	(5) Average of 29 specimens.
Length	24	22	16	13·5	18·836 mm.
Height	22·5	21	16	13	18·077 ,,

(1—5) from Blackdown.

Affinities.—A species from the Aachen Greensand was described and figured by Goldfuss as *P. sublævis*, Sowerby; but it has been shown by later authors to be distinct from the latter; Römer[1] and also Brauns,[2] have referred it to *P. lens*, Nilsson,[3] but the characters of that form are known only from internal casts. Böhm[4] has named the Aachen form *P. dux*, but Holzapfel,[5] in a later work, refers it to *P. Geinitzi*, d'Orbigny,[6] the type of which is *P. sublævis*, Geinitz,[7] *non* Sowerby, from Kieslingswald. The Aachen species is rather variable, but a comparison of several specimens and of the good series of figures given by Holzapfel, shows that it generally differs from *P. sublævis*, Sowerby, in the following features:

(1) The average size of the adults is considerably larger, and the valves are less inflated than in *P. sublævis*.

(2) The hinge-area is smaller and the external teeth shorter.

(3) The shell is more quadrate in form, and, as a rule, a little higher than long.

(4) The ribs are more flattened and are separated by striæ.

[1] 'Die Verstein. des norddeutsch. Kreidegeb.' (1841), p. 68.

[2] "Die senon Mergel des Salzberges., &c.," 'Zeitsch. f. d. gesammt. Naturwiss.,' vol. xlvi (1876), p. 383.

[3] 'Petrif. Suecana' (1827), p. 15, pl. v, fig. 4; Hennig, 'Revis. af Lamellibr. i Nilsson's "Petrif. Suecana,"' 'Kongl. Fysiogr. i Lund Handl.,' vol. viii (1897), p. 63.

[4] 'Verhandl. des naturhist. Vereines der preuss. Rheinl., &c.,' vol. xlii (1885), p. 93.

[5] "Die Mollusk. der Aachen. Kreide.," 'Palæontographica,' vol. xxxv (1889), p. 210, pl. xxiii, figs. 11, 12; pl. xxiv, figs. 1—10.

[6] 'Prodr. de Pal.,' vol. ii (1850), p. 196.

[7] 'Die Verstein. von Kieslingswalda' (1843), p. 14, pl. ii, figs. 19—21.

In *P. obsoletus*, Goldfuss,[1] the shell is oblique, and more oval and rounded in form than in *P. sublævis*.

P. subpulvinatus, d'Archiac,[2] from the Tourtia of Tournay, is also more oblique and has the posterior border more rounded.

For the relation of this species to *P. umbonatus*, Sowerby, see p. 70.

The two examples described by Keeping (*vide supra*) from the Lower Greensand of Upware appear to differ from *P. sublævis* in being less inflated and in having a higher area, but the specimens are not sufficiently perfect to allow me to give a definite opinion on their affinities.

Types.—From Blackdown; in the British Museum.

Distribution.—Greensand of Blackdown (zones xi and xii); Lower Gault (zone vi) of Folkestone (*fide* Price).

PECTUNCULUS UMBONATUS (*Sowerby*), 1817. Plate XIV, figs. 8 *a*—*c*, 9 *a*—*c*, 10 *a*—*c*, 11, 12.

1817.	CARDIUM UMBONATUM, *J. Sowerby*.		Min. Conch., vol. ii, p. 128, pl. clvi, figs. 2—4.
1824.	PECTUNCULUS UMBONATUS, *J. de C. Sowerby*.		Ibid., vol. v, p. 113, pl. ccclxxii, fig. 3.
1851.	—	—	*J. Morris*. Cat. Brit. Foss., ed. 2, p. 220.
1868.	—	—	*A. Briart and F. L. Cornet*. Descript. de la Meule de Braequegnies (Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg., vol. xxxiv), p. 61, pl. v, figs. 19, 20?
Non 1837.	—	—	*A. Goldfuss*. Petref. Germ., vol. ii, p. 160, pl. cxxvi, fig. 2.
? — 1841.	—	—	*F. A. Römer*. Die Verstein. des norddeutsch. Kreideformat., p. 68.
— 1846.	—	—	*A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. ii, p. 9, pl. xli, fig. 20.
— 1857.	—	—	*J. W. Salter*. Quart. Journ. Geol. Soc., vol. xiii, p. 86. (For remarks on this form see Jukes-Browne, Geol. Mag., 1898, p. 29.)

Description.—Shell rather inflated and more or less circular or slightly subquadrate, usually a little higher than long, nearly equilateral. Anterior margin

[1] 'Petref. Germ.,' vol. ii (1837), p. 160, pl. cxxvi, fig. 4; Geinitz, "Das Elbthalgeb. in Sachsen" 'Palæontographica,' vol. xx, pt. i (1873), p. 223, pl. xlix, figs. 7—11.

[2] 'Mém. Soc. Géol. de France,' ser. 2, vol. xii (1846), p. 306, pl. xv, fig. 2.

generally evenly rounded, sometimes forming an obtuse but rounded angle with the hinge-margin. Posterior extremity slightly angular; dorsal part of the posterior margin subtruncate, straight or slightly curved. Hinge-line long. Umbones prominent, pointed; valves compressed in the postero-dorsal region. Hinge-area broad, with several ligament-grooves. Ornamentation consists of broad radial ribs bearing finer ribs, and separated by narrow grooves; the ribs are crossed by lines of growth and by faintly marked concentric ridges.[1] On the anterior and posterior parts of the valves the radial ribs are less distinct. Central teeth (two to four) small, transverse; lateral teeth (eight to ten) long and oblique. Anterior adductor impression large, subtrigonal; posterior adductor a little smaller and rounded. Margins of valves strongly crenulate.

Measurements:

	(1)	(2)	(3)	(4) Average of 27 specimens.
Length	18	17	15	18·851 mm.
Height	20	19	16	19·924 ,,

(1—4) from Blackdown.

Affinities.—This species differs from *P. sublævis*, Sowerby, in the shell being less stout, more inflated, and usually higher than long; also in having a broader hinge-area, more prominent umbones, and fewer ribs. It resembles *P. noricus*, Zittel,[2] in general form, but that species appears to be usually larger, with rather less prominent umbones, fewer ribs, and less oblique lateral teeth.

The form from the Senonian of Coesfeld and Quedlinburg, which was referred by Goldfuss (*vide supra*) to this species, has been regarded as distinct by Römer,[3] and named *P. decussatus;* a fuller description, but without figures, is given by Brauns.[4] I have seen no examples of that form. The name was changed by d'Orbigny[5] to *subdecussatus*, since *decussatus* had been used previously (1813) by Sowerby for an Eocene species.

Types.—From Blackdown; in the British Museum.

Distribution.—Blackdown Greensand (zone vii, and occasionally beneath it). Lower Gault (zones vi and vii) of Folkestone (*fide* Price). Folkestone Beds of Copt Point, Folkestone.[6]

[1] Seen in only a few specimens.

[2] "Die Bivalv. der Gosaugeb.," pt. i, 'Denkschr. der k. Akad. der Wissensch. Math.-nat. Cl.,' vol. xxiv (1865), p. 167, pl. ix, fig. 9.

[3] 'Die Verstein. des norddeutsch. Kreidegeb.' (1841), p. 69.

[4] "Die senon. Mergel des Salzberges, &c.," 'Zeitsch. f. d. gesammt. Naturwiss.,' vol. xlvi (1876), p. 383.

[5] 'Prodr. de Pal.,' vol. ii (1850), p. 243.

[6] There are three specimens from this horizon in the Woodwardian Museum; the surface of the shell is not perfectly preserved, but I have very little doubt that they are referable to this species.

PECTUNCULUS EUGLYPHUS, sp. nov. Plate XIV, figs. 13 *a*—*c*.

Description.—Shell inflated, nearly equilateral, outline rounded, length and height nearly equal; posterior border (especially its dorsal part) less curved than the anterior. Umbones large. Hinge-line moderately long. Ornamentation consists (1) on the anterior part of the valves of numerous fine, rounded, radial ribs, crossed by very faint concentric ridges and a few distant growth-lines; the radial ribs are separated by well-marked but narrow grooves with puncta; (2) on the posterior part of the valves of broader, flatter radial ribs, crossed in a regular manner by fine, rather closely-set concentric ridges.

Measurements:

Length	22 mm.
Height	22 ,,

Affinities.—*Pectunculus subpulvinatus*, d'Archiac, from the Tourtia of Tournay, apparently differs from this species in the obliquity and greater convexity of the valves, and in the ornamentation being somewhat coarser and of the same type on the anterior and posterior parts of the shell.

P. euglyphus is more inflated than *P. sublævis*, and also differs in the character of the ornamentation.

Types.—Three specimens in Mr. Meÿer's collection.

Distribution.—Chalk Marl (Meÿer's Bed ii) of Dunscombe.

Genus—LIMOPSIS, *A. Sasso*, 1827.

['Giornale Ligustico di Scienze,' i, p. 476.]

LIMOPSIS ALBIENSIS, sp. nov. Plate XV, figs. 1 *a*—*d*, 2—4.

1874. PECTUNCULUS, sp., *F. G. H. Price.* Quart. Journ. Geol. Soc., vol. xxx, p. 360 (in list from Bed ii).

1879. — — (= LUCINA ORBICULARIS ?), *Price.* The Gault, p. 62.

Description.—Shell small, oval, shorter than high, somewhat inequilateral and oblique, of moderate convexity, compressed postero-dorsally. Anterior and ventral margins evenly rounded, posterior less curved and forming a blunt angle with the hinge-line. Umbones of moderate size, pointed. Hinge-line long, more extended posteriorly than anteriorly. Hinge-area long. Ornamentation consists of broad, flattened concentric ridges, separated by sharp, narrow grooves. Radial

ribs slender, faintly marked, sometimes indistinct in part, better marked near the umbones and on the postero-dorsal region than elsewhere. Anterior teeth (about five) short and nearly perpendicular; posterior (about six) more oblique, the external being nearly horizontal. Margins entire.

Measurements:

	(1)	(2)	(3)
Length	5·5	4·25	3·75 mm.
Height	6·0	4·5	4·0 ,,

Affinities.—This appears to be similar to the form described as *Pectunculus insculptus*, Reuss, from the Priesen Beds of Bohemia, but since the figures[1] of that form show casts only it is difficult to determine its affinities. The hinge-line in *P. insculptus* seems to be much more curved, forming a fairly sharp angle at the umbo, and the teeth are also more numerous than in *L. albiensis*.

In *P. reticulatus*, Reuss,[2] the radial ribs are much better marked than in *L. albiensis*.

Types.—In the Museum of Practical Geology.

Distribution.—Lower Gault (zones ii, iii, and vii) of Folkestone.

Limopsis, sp. Plate XV, figs. 5 *a*—*c*, 6 *a*—*c*.

1897. Limopsis, sp., *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 379, pl. xxvii, figs. 7, 8.

Description.—Shell small, oval, convex, a little oblique, higher than long; margins of valves not crenulate. Casts show fine radial striæ, sometimes crossed by a few shallow concentric furrows.

Measurements:

Length	8 mm.
Height	7 ,,

Remarks.—At present this species is known only from internal casts, so that a complete description cannot be given; it seems, however, to be distinct from other forms.[3] I have not been able to make out satisfactorily the hinge

[1] Geinitz, 'Char. der Schicht. u. Petref. d. sachs.-böhm. Kreidegeb.,' pt. iii (1842), p. 78, pl. xx, fig. 17; Reuss, 'Die Verstein. der böhm. Kreidef.,' pt. ii (1846), p. 8, pl. xxxv, fig. 5; Fritsch, 'Stud. im gebiete der böhm. Kreidef.,' v. Priesener Schichten (1893), p. 93, fig. 106.

[2] Reuss, ibid., p. 8, pl. xxxv, figs. 7, 8.

[3] Compare with the following, most of which are known as casts only:

(i) *L. calvus*, Sowerby, 'Trans. Geol. Soc.,' ser. 2, vol. iii (1832), p. 417, pl. xxxviii, fig. 2; Zittel, "Die Bivalv. der Gosaugeb.," 'Denkschr. d. k. Ak. d. Wissensch. Wien. Math.-nat. Cl.,' vol. xxiv (1865), p. 165, pl. ix, fig. 8.

(ii) *L. rhomboidalis*, Alth, 'Haidinger's Naturwiss. Abhandl.,' vol. iii, pt. 2 (1850), p. 233, pl. xii, fig. 17; Favre, 'Moll. Foss. Craie de Lemberg' (1869), p. 121, pl. xii, figs. 11, 12.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1900.

LONDON:

MDCCCC.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

PART II.

TRIGONIIDÆ, MYTILIDÆ, AND DREISSENSIIDÆ.

PAGES 73—112; PLATES XV—XIX.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY

1900.

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C., AND 20, HANOVER SQUARE, W.

and hinge-area; it is therefore possible that this form may belong to *Pectunculus*.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

Family—TRIGONIIDÆ, *Lamarck*.

Genus—Trigonia, *Bruguière*, 1789.

('Encyc. Méth. Vers.,' vol. i, p. xiv; Lamarck, 'Syst. Anim. sans Vert.,' 1801, p. 116.)

The British forms of this genus have already been considered in detail by Mr. Lycett in his 'Monograph of the British Fossil Trigoniæ,' published by the Palæontographical Society in 1872–9; it will therefore not be necessary, in the present work, to do more than enumerate the Cretaceous species, and to give some additional notes on their affinities, synonymy, etc.

Section 1.—Scaphoidea.

Trigonia scapha, *Agassiz*, 1840. Plate XX, figs. 1, 2.

Additional Synonymy.

1861.	Trigonia hunstantonensis,	*H. Seeley.*		Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 123, pl. vi, fig. 9.
1877.	—	scapha, *Lycett*, p. 183, pl. xxxviii, fig. 6.		
1884.	—	—	*O. Weerth.*	Die Fauna Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 45.
1896.	—	—	*A. Wollemann.*	Zeitschr. d. deutschr. geol. Gesellsch., vol. xlviii, p. 846.
1900.	—	—	—	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms. (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 92.

(iii) *L. radiata.* Alth, ibid., p. 234, pl. xii, fig. 19; Favre, ibid., p. 122, pl. xii, fig. 13.

(iv) *L. plana.* Römer, 'Die Verstein. des norddeutsch. Kreidegeb.' (1841), p. 69, pl. viii, fig. 24; Griepenkerl, "Senon. Kreide von Königslutter," 'Palæont. Abhandl.,' vol. iv (1889), p. 56. In this form the valves appear to be flatter and the umbones less prominent than in the English species described above.

(v) *Pectunculus? insculptus*, Reuss, 'Die Verstein. der böhm. Kreideformat.,' pt. ii (1846), p. 8, pl. xxxv, fig. 5; Fritsch, 'Stud. im Gebiete der böhm. Kreideformat., v. Priesener Schichten' (1893), p. 93, fig. 106.

Remarks.—From Agassiz' figures alone it would be difficult to feel sure of the identity of the English form, described by Seeley as *T. hunstantonensis*, with *T. scapha*, Agassiz; but the figures of Pictet and Campiche give a much better idea of the characters of the species. Seeley's figure is more accurate than Lycett's, but the arrangement of the tubercles is not satisfactorily shown.

Types.—The type of *T. scapha* is from the Neocomian near Neuchâtel. The type of *T. hunstantonensis* is in the Woodwardian Museum; it was at first stated to come from the Red Chalk, but the matrix differs entirely from the Red Chalk, and the specimen in all probability is from the Snettisham Ironstone nodules[1] (Lower Greensand), West Norfolk.

Distribution.—Snettisham Ironstone of Sandringham Warren and Wolferton Station. Snettisham Clay of Heacham and Snettisham. The records of this species from the Red Chalk of Hunstanton are probably erroneous.

Trigonia exaltata, *Lycett*, 1877.

1877. *Lycett*, p. 184, pl. xxxviii, fig. 2.

Type.—In the British Museum.

Distribution.—Lower Greensand of West Norfolk.

Trigonia Robinaldina? *d'Orbigny*, 1844.

1844.	Trigonia Robinaldina,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 139, pl. ccxcix, figs. 1, 2.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 78.
1866.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 385.

An internal cast from the Tealby Limestone (zone of *Bel. brunsvicensis*) of Claxby, now in the Woodwardian Museum, probably belongs to this species.

[1] See Lamplugh, in Whitaker and Jukes-Browne, "Geol. Borders of the Wash" ('Mem. Geol. Survey,' 1899), p. 16, etc.

Section 2.—Clavellatæ.

Trigonia ingens, *Lycett*, 1872.

1872. *Lycett*, p. 24, pl. viii, figs. 1—3.
1877–9. Ibid., p. 207, pl. xxxvi, figs. 5, 6.
1877. Trigonia Keepingi, *Lycett*. Ibid., p. 196, pl. xxxv, figs. 1, 2.

Remarks.—Maas[1] states that his *T. roelligiana*, from the Gault of Wilhelmshöhe, near Langenstein, is related to *T. ingens*; but it seems to be clearly distinguished by the greater curvature of the ribs near the carina and the indistinctness or absence of tubercles.

T. Keepingi, Lycett, is known only by the two type specimens from the Spilsby Sandstone. I have carefully compared these with a large series of *T. ingens* from the Claxby Ironstone—the chief horizon for that species, and find that the curvature and number of the costæ and the size of the tubercles vary considerably in different specimens of *T. ingens;* some forms possessing smaller and more numerous tubercles agree perfectly, in these respects, with *T. Keepingi*. The plications on the area of the smaller specimen of *T. Keepingi* are quite similar to those on *T. ingens;* but on the larger specimen they are less distinct than usual; this, I think, is accounted for by imperfect preservation. In comparing the form of the shell in the larger example of *T. Keepingi* with that of *T. ingens* it is important to note that that specimen is larger than usual, and that the whole of the marginal parts posterior to the umbo are very imperfect, so that a false idea may at first be taken of the height of the shell. Lycett's figures, although giving a good idea of the character of the shell, are not accurate in either outline or size.

Types.—*T. ingens*, from the Carstone of Downham, was formerly in the museum at Lynn, but cannot now be found. Specimens figured on Lycett's plate xxxvi, from the Claxby Ironstone, are in the Museum of Practical Geology; and also a gutta-percha cast of the original of plate viii, fig. 1.

T. Keepingi, from the Spilsby Sandstone, in the Woodwardian Museum.

Distribution.—Spilsby Sandstone (zone of *Bel. lateralis*) of Claxby and Donnington. Claxby Ironstone (zone of *Bel. lateralis*) of Benniworth Haven. Carstone of Downham, Norfolk.

The specimens named *T. Keepingi* are from the Spilsby Sandstone (zone of *Bel. lateralis*) of Claxby and Tealby.

[1] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xlvii (1895), p. 282, pl. ix, fig. 7.

Section 3.—Glabræ.

Trigonia eccentrica, *Parkinson*, 1811.

1811. Trigonia eccentrica, *J. Parkinson.* Org. Remains, vol. iii, p. 175, pl. xii, fig. 5.
1811. — sinuata, *Parkinson.* Ibid., p. 177, pl. xii, fig. 13.
1818. — eccentrica, *J. Sowerby.* Min. Conch., vol. iii, p. 11, pl. ccviii, figs. 1, 2.
1828. — excentrica, *Defrance.* Dict. Sciences nat., vol. lv, p. 296.
1837. — — *G. G. Pusch.* Polens Paläont., p. 61.
1837. — sinuata, *Pusch.* Ibid., p. 61.
1840. — excentrica, *L. Agassiz.* Études crit. Moll. Foss. (Trigon.), p. 9.
1848. Lyriodon sinuatus, *H. G. Bronn.* Index Palæont., vol. i, p. 688 (*partim*).
1848. — excentricus, *Bronn.* Ibid., p. 686 (*partim*).
1850. Trigonia excentrica, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 162.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 228.
1866. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 387.
1866. — sinuata, *Pictet and Campiche.* Ibid., p. 387 (*partim*).
1875. — excentrica, *Lycett*, p. 94 (*partim*), pl. xx, fig. 6 (not 5); pl. xxi, fig. 6; pl. xxii, fig. 5; pl. xxviii, figs. 6, 9, 10.

Non 1837. Lyrodon excentricum, *A. Goldfuss.* Petref. Germ., vol. ii, p. 203, pl. cxxxvii, fig. 8 (= *Trigonia Micheloti*, de Loriol).
— 1847. Trigonia excentrica, *J. Müller.* Petref. Aachen. Kreideformat., pt. 1, p. 16.
— 1847. — sinuata, *A. d'Orbigny.* Voy. Astrol. Paléont., pl. iv, figs. 29, 30.

Remarks.—This is distinguished from *T. affinis*, Sowerby, by being proportionately longer, more produced posteriorly, less ovoid in outline, and in having the costæ near the antero-ventral margin less regularly concentric (except in small specimens).

Types.—I have not seen Parkinson's types. The specimen figured by Sowerby is in the British Museum. Specimens figured by Lycett are in the Museum of Practical Geology (pl. xxi, fig. 6; pl. xxii, fig. 5), and in Mr. Vicary's collection (pl. xx, fig. 6; pl. xxviii, figs. 6, 9, 10). The original of pl. xx, fig. 5, stated by Lycett to be from Blackdown, is in the British Museum (No. 32396); it is really from the Cenomanian of Le Mans, and is an example of *T. sinuata*, d'Orbigny (*non* Parkinson)—see *T. affinis*.

Distribution.—Greensand of Blackdown (Zone xi), Haldon, and Kingskerswell.

TRIGONIA LÆVIUSCULA, *Lycett*, 1875.

1875. *Lycett*, p. 96, pl. xxii, fig. 6.

Remarks.—I doubt whether this can be regarded as more than a variety of *T. eccentrica*, Parkinson. The only specimens I have seen are those referred to by Lycett. More material is needed to allow of a definite opinion being given.

Type.—From the Greensand of Cullompton; in Mr. Vicary's collection.

Distribution.—Blackdown Greensand of Collumpton. Lycett states that this species was obtained by Mr. Meÿer from the Cenomanian of Dunscombe, but the specimens do not appear to be in Mr. Meÿer's collection.

TRIGONIA AFFINIS, *Sowerby*, 1818.

1818. TRIGONIA AFFINIS, *J. Sowerby* (ex *Miller*, MS.). Min. Conch., vol. iii, p. 11, pl. ccviii, fig. 3.
1828. — — *Defrance.* Dict. Sciences nat., vol. lv, p. 297.
1840. — — *L. Agassiz.* Études crit. Moll. Foss. (Trigon.), p. 9.
1844. — SINUATA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 147, pl. ccxciii.
1848. LYRIODON SINUATUS, *H. G. Bronn.* Index Palæont., vol. i, p. 688 (*partim*).
1850. TRIGONIA SINUATA, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 161.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 229.
? 1867. — — *E. Guéranger.* Album Paléont. de la Sarthe, p. 14, pl. xix, fig. 4.
1875. — EXCENTRICA, *Lycett*, pl. xx, fig. 5 (from Le Mans).
1877. — AFFINIS, *Lycett*, p. 187, pl. xxi, fig. 7; pl. xl, fig. 2 (from Le Mans).
1896. — — *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 153.

Remarks.—I have compared examples of this species with *T. sinuata*, d'Orbigny (*non* Parkinson), from the Cenomanian of Le Mans, and consider that, as maintained by d'Orbigny, the two are identical. Two specimens from Le Mans were accidentally figured by Lycett as English examples (see below).

Types.—The type is in the Bristol Museum. One of the specimens figured by Lycett (pl. xl, fig. 2) is in Mr. Vicary's collection; the other (pl. xxi, fig. 7), stated to be from Blackdown, is in the British Museum (No. 32396), and was really obtained from the Cenomanian of Le Mans; the original of pl. xx, fig. 5 (figured as *T. excentrica*), is also from the same locality, and is in the British Museum. Casts of these two specimens, labelled *T. sinuata* by Lycett, are in the Scarborough Museum.

Distribution.—Greensand of Blackdown and Haldon. ? Cenomanian of Axmouth Meÿer collection.

TRIGONIA DUNSCOMBENSIS, *Lycett*, 1877. Plate XIX, figs. 12 *a*, *b*.

1877. *Lycett*, p. 188, pl. xl, figs. 5, 6; pl. xli, fig. 14.
1896. *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 153.

Remarks.—Messrs. Jukes-Browne and Hill consider that *T. dunscombensis* is probably identical with *T. sinuata*, d'Orbigny (*non* Parkinson) which I regard as a synonym of *T. affinis* (see p. 77). Small forms (35 mm. long) seem to be inseparable, unless it is by the somewhat greater convexity of *T. dunscombensis*, but the larger examples of the latter (*e. g.* Lycett's fig. 5) seem to differ in having a less ovoid outline and fewer ribs. More specimens of *T. dunscombensis* are needed before its affinities can be definitely settled.

Types.—Figs. 5 and 6, from near Sidmouth, are in Mr. Meÿer's collection. The original of pl. xli, fig. 14, from Dunscombe, is in the Museum of Practical Geology.

Distribution.—Cenomanian (Beds 10, 11, and 12 of Meÿer) of Dunscombe, Branscombe, Whitecliff, and Pinhay; Bed 11 of Humble Point, Lyme Regis. Base of Chalk Marl (zone of *Schlœnbachia varians*) of Titherleigh.

TRIGONIA DEBILIS, *Lycett*, 1877.

1877. *Lycett*, p. 189, pl. xl, fig. 8; pl. xli, fig. 5.
1896. *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 154.

Types.—In Mr. Meÿer's collection (fig. 8), and in the Museum of Practical Geology (fig. 5).

Distribution.—Cenomanian (Bed 10) of Dunscombe.

Section 4.—QUADRATÆ.

TRIGONIA NODOSA, *Sowerby*, 1826.

1822. TRIGONIA CLAVELLATA, *G. Mantell* (non *Sowerby*). Foss. S. Downs, p. 73.
1826. — NODOSA, *J. de C. Sowerby.* Min. Conch., vol. vi, p. 7, pl. dvii, fig. 1.
?1840. — CINCTA, *L. Agassiz.* Etudes crit. Moll. Foss. (Trigon.), p. 27, pl. vii, figs. 21, 23; pl. viii, figs. 2—4.
1844. — RUDIS, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 137, pl. cclxxxix.

1850. Trigonia rudis, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 78 (*? partim*).
1854. — nodosa, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 229.
? 1855. — rudis, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 76.
1857. — dædalea, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 92, pl. xii, fig. 1.
1857. — nodosa, *Pictet and Renevier*. Ibid., p. 94, pl. xii, fig. 2.
1865. — — *H. Coquand*. Mon. Aptien de l'Espagne, p. 133.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 385.
1875. — — *Lycett*, p. 106, pl. xxv, figs. 1, 2; pl. xxxvii, figs. 5, 6.
1875. — — var. Orbignyana, *Lycett*. Ibid., p. 107, pl. xxiv, figs. 1—3.
1896. — — *A. Wollemann*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 846.
1900. — — — Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 90, pl. iv, fig. 8.

Non 1852. — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 454, pl. xxxv, fig. 5.

Remarks.—There appears to be a perfect passage from the typical *T. nodosa* to the variety named by Lycett *Orbignyana*.

Lycett regarded *T. cincta*, Agassiz, as a synonym of *T. nodosa*; I have seen no examples of the former, but its area appears to be proportionately larger, while the ribs seem to be more nearly perpendicular to the carina and more nearly parallel to the ventral margin than in the English specimens.

Types.—I have not found the type; it came from the Hythe Beds of Hythe. The specimens figured by Lycett are in the Museum of Practical Geology.

Distribution.—Hythe Beds of Hythe and Lympne. Crackers of Atherfield. *Perna*-bed of Atherfield and Redcliff. Folkestone Beds near Copt Point, Folkestone. Claxby Ironstone of Tealby (*fide* Lycett).

Trigonia tealbyensis, *Lycett*, 1875.

1875. *Lycett*, p. 114, pl. xxviii, fig. 7.

Type.—In the Woodwardian Museum, Cambridge.

Distribution.—Spilsby Sandstone (zone of *Bel. lateralis*) of Claxby.

TRIGONIA DÆDALEA, *Parkinson*, 1811.

Additional Synonymy.

1828. TRIGONIA DÆDALEA, *Defrance*. Dict. Sciences nat., vol. lv, p. 294.
1868. — — *A. Briart and F. L. Cornet*. Descript. Mineralog. Géol. et Pal. de la Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 64, pl. vi, figs. 1—3.
1875. — — *Lycett*, p. 100, pl. xxii, figs. 7, 8; pl. xxiii, figs. 2, 3; pl. xxviii, fig. 8.
1875. — — var. CONFUSA, *Lycett*, p. 102, pl. xxiii, fig. 1.

Non 1819. — DÆDALEA, *Lamarck*. Anim. sans Vert., vol. vi, p. 63 (ed. 2, 1835, p. 516), from Le Mans.
— 1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 371.

Remarks.—Lycett regarded *T. palmata*, Deshayes,[1] as a variety of *T. dædalea;* but it should be noted that the former occurs at a distinctly lower horizon than the latter, namely, in the Middle Neocomian of the Aube. I have seen no example of *T. palmata*.

Types.—I have not found the type. The specimens figured by Sowerby are in the British Museum; those figured by Lycett are in the Museum of Practical Geology, except the type of the variety *confusa*, which is in Mr. Vicary's collection. The type of *T. quadrata*, Sowerby, is in the Bristol Museum.

Distribution.—Greensand of Blackdown (Zone xii) and Haldon.

TRIGONIA SPECTABILIS, *Sowerby*, 1826.

1875. *Lycett*, p. 112, pl. xxxvi, figs. 1—4.

Remarks.—I do not think that Lycett's view of the identity of the species figured by Pictet and Roux[2] as *T. nodosa* with *T. spectabilis* can be maintained. In the former the area is smaller, the posterior extremity more produced and rounded, the tubercles smaller and more rounded and not forming such distinct rows as in *T. spectabilis*.

[1] 'Mém. Soc. géol. France,' vol. v (1842), p. 7, pl. viii, fig. 5.
[2] 'Moll. Foss. Grès verts de Genève' (1852), p. 454, pl. xxxv, fig. 5.

Types.—I have not found the type. The specimens figured by Lycett are in the Museum of Practical Geology (figs. 1—3), and in Mr. Vicary's collection (fig. 4).

Distribution.—Blackdown Greensand (Zone x).

Section 5.—Scabræ.

Trigonia Etheridgei, *Lycett*, 1875.

1875. *Lycett*, p. 127, pl. xxvii, figs. 1—3.

Types.—In the Museum of Practical Geology.

Distribution.—*Perna*-bed of Atherfield.

Trigonia caudata, *Agassiz*, 1840.

Additional Synonymy.

? 1852. Trigonia aliformis, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, pl. xxxv, fig. 1 (not fig. 2), p. 450.

1866. — caudata, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 374.

1869. — — *P. de Loriol and V. Gilliéron.* Mon. Urgonien Infér. du Landeron (Mém. Soc. helvét. Sci. nat., vol. xxiii), p. 15.

1875. — — *Lycett*, p. 129, pl. xxvi, figs. 5—7.

1895. — — *G. Maas.* Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 264.

1900. — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 89.

Types.—From the Neocomian of Neuchâtel. The specimens figured by Lycett are in the Museum of Practical Geology.

Distribution.—Crackers of Atherfield. Recorded by Topley (1875) from several localities in the Weald—I have not seen the specimens; it is probable that some of them are examples of *T. vectiana*.

TRIGONIA SCABRICOLA, *Lycett*, 1875.

1875. *Lycett*, p. 130, pl. xxvii, figs. 4, 5.

Remarks.—This form is very closely connected with *T. caudata* from the Lower Greensand—indeed, some specimens appear to be almost inseparable from that species; but the majority of the Upper Greensand examples have rather more numerous and closer ribs towards the umbo, the shell less produced posteriorly, and its height somewhat greater in proportion. It should, however, be noted that a specimen from the Aptian of the Perte-du-Rhône, figured by Pictet and Renevier,[1] agrees perfectly with examples of *T. scabricola* from Blackdown and Haldon.

Types.—From Blackdown, in the Museum of Practical Geology.

Distribution.—Greensand of Blackdown, Haldon, and Devizes.

TRIGONIA CRENULIFERA, *Lycett*, 1877.

1877. *Lycett*, p. 189, pl. xl, figs. 1, 7, 9.
1896. *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 154.

Remarks.—The more prominent and fewer costæ, and the greater slope of the area and escutcheon, which Lycett regarded as features distinguishing this from *T. crenulata*, d'Orbigny, vary considerably in different specimens, as may be seen by comparing Lycett's figures 1 and 9. In one example of *T. crenulata* in the British Museum, from Le Mans, the costæ are actually fewer than in a form of *T. crenulifera* of the same size. The costellæ on the area, however, seem to separate *T. crenulifera* from *T. crenulata;* in the latter they appear to be found only near the anterior end of the area.

Types.—In Mr. Meÿer's collection (figs. 1 and 7), and in the Museum of Practical Geology (fig. 9).

Distribution.—Cenomanian (Beds 10 and 11), near Beer Head, Dunscombe, and Pinhay Cliff.

TRIGONIA CRENULATA, *Lamarck*, 1819. Plate XIX, fig. 14.

1819. TRIGONIA CRENULATA, *Lamarck.* Anim. sans vert., vol. vi, p. 63.
1828. — — *Defrance.* Dict. Sciences nat., vol. lv, p. 294.

[1] "Foss. Aptien de la Perte du Rhône" ('Matér. Pal. Suisse,' ser. 1, 1857), pl. xiii, fig. 1.

1835.	Trigonia crenulata,	*Lamarck.*	Ibid., ed. 2, vol. vi, p. 515.
1840.	—	—	*L. Agassiz.* Études crit. Moll. Foss. (Trigon.), p. 32, pl. vi, figs. 4—6.
1844.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 151, pl. cexev.
1848.	Lyriodon crenulatus,	*H. G. Bronn.*	Index Pakeont., vol. i, p. 186.
1850.	Trigonia crenulata,	*A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 161.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 388.
1867.	—	—	*E. Guéranger.* Album Paléont. de la Sarthe, p. 14, pl. xviii, figs. 3, 4.
? 1878.	—	—	*O. Fraas.* Aus dem Orient., vol. ii, Geol. Beobacht. Libanon, p. 70.
1896.	—	—	*A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 154.

Remarks.—I have seen only one English example of this. The surface is not quite perfectly preserved, so that the rugose character of the costæ is not well seen.

Type.—From the Cenomanian of Le Mans.

Distribution.—Cenomanian (Meÿer's Bed 10) of Dunscombe.

Trigonia aliformis, *Parkinson*, 1811.

Additional Synonymy.

1828.	Trigonia alæformis,	*Defrance.*	Dict. Sciences nat., vol. lv, p. 297.
1850.	—	aliformis, *G. P. Deshayes.*	Traité Elément. Conch., vol. ii, p. 258, pl. xxxiii, fig. 3.
? 1865.	—	— *H. Coquand.*	Mon. Aptien de l'Espagne, p. 134.
? 1866.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 377, 386, pl. cxxviii, fig. 9.
1875.	—	— *Lycett*, p. 116, pl. xxv, figs. 3—6; pl. xxviii, fig. 5.	
1897.	—	— *R. B. Newton.*	Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 95, pl. iii, fig. 14.
Non 1841.	—	alæformis, *F. A. Römer.*	Die Verstein. des nord-deutsch. Kreidegeb., p. 68.
— 1843.	—	— *H. B. Geinitz.*	Die Verstein. von Kieslingswalda, p. 14, pl. ii, figs. 15, 16.
— ? 1846.	—	— *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 5.
— 1847.	—	— *J. Müller.*	Mon. Petref. der Aachen. Kreideformat., pt. 1, p. 15.
— 1863.	—	aliformis, *R. Drescher.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 348.

Non 1873. Trigonia aliformis, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 2, p. 58.

— 1897. — alæformis, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. vi. Die Chlomeker Schichten, p. 55, fig. 60.

Types.—From Blackdown. I have not been able to trace the type. Sowerby's specimens are in the British Museum, except the original of fig. 3, which is in the Bristol Museum. The specimens figured by Lycett are in the Museum of Practical Geology (figs. 3—6), and in Mr. Vicary's collection (pl. xxviii, fig. 5). The specimen figured by Newton is in the British Museum.

Distribution.—Greensand of Blackdown (Zones iv to vi) and Devizes. Stated by Lycett to occur at Haldon, but not recorded by Downes (1882); I have seen no example from that locality. Zone of *Hoplites interruptus* of Okeford Fitzpaine. The variety *attenuata* is found in the Upper Greensand of Niton, Ventnor, and Warminster. Agassiz'[1] record of this form from the Greensand near Cambridge is erroneous. ? Folkestone Beds of Copt Point, Folkestone.

Trigonia Meyeri, *Lycett*, 1875.

1875. *Lycett*, p. 125, pl. xxiii, fig. 6; pl. xli, figs. 15, 16.

1896. *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 154.

Types.—In the Museum of Practical Geology—from near Sidmouth and Dunscombe.

Distribution.—Cenomanian (Meÿer's Beds 10, 11, 12) of Dunscombe, Culver Hole (Devon), west of Pinhay, etc. Base of Chalk Marl (zone of *Schlœnbachia varians*) of Titherleigh, near Chard.

Trigonia Vectiana, *Lycett*, 1875.

Additional Synonymy.

1818. Trigonia alæformis, *J. Sowerby.* Min. Conch., vol. iii, p. 27 (*partim*), pl. ccxv, fig. 2 (not 1, 3, 4).

1875. — Vectiana, *Lycett*, p. 123, pl. xxiv, figs. 10, 11; pl. xxv, fig. 7.

Types.—Museum of Practical Geology—from the *Perna*-bed of Atherfield.

Distribution.—*Perna*-bed and Bed 45 (Fitton) of Atherfield. *Perna*-bed of

[1] 'Études crit. Moll. Foss.,' Trigon. (1840), p. 31.

Redcliff, near Sandown. Ferruginous Sands of Shanklin. Hythe Beds of Hythe, etc. Atherfield Beds of Sevenoaks. Lower Greensand of Seend (*fide* Lycett). Sandgate Beds of Parham Park.

TRIGONIA ORNATA, *d'Orbigny*, 1844. Plate XIX, fig. 13.

Additional Synonymy.

? 1855.	TRIGONIA ORNATA,	*G. Cotteau.* Moll. Foss. de l'Yonne, p. 76.
? 1858.	—	— *J. Vilanova-y-Piera.* Mém. Geogr.-agric. de Castellon, pl. ii, fig. 14.
? 1865.	—	— *H. Coquand.* Mon. Aptien de l'Espagne, p. 137.
1866.	—	— *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 373, 385.
1867.	—	— *P. de Loriol.* In A. Favre, Rech. géol. dans Savoie, etc., vol. i, p. 379, pl. c, fig. 8.
? 1871.	—	— *W. A. Ooster and C. v. Fischer-Ooster.* Protoz. Helvet., vol. ii, p. 101, pl. xv, fig. 18.
1875.	—	— *Lycett*, p. 139, pl. xxiv, figs. 6, 7.
1884.	—	sp. indet. (2nd), *O. Weerth.* Die Fauna Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), pp. 45, 46.
1896.	—	ORNATA, *A. Wollemann.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 847.
? 1899.	—	— *G. Maas.* Ibid., vol. li, p. 248.
1900.	—	— *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 88.

Remarks.—The English specimens agree better with the example figured by Pictet and Renevier than with the type, in which the costæ are less numerous. A specimen from Lympne (Plate XIX, fig. 13) possesses fewer costæ than the examples found at Atherfield, and in this character, as also in general shape, it approaches more nearly the foreign examples.

The specimen from Shorncliffe, figured by Sowerby[1] as *T. spinosa*, var., has been regarded by several authors as *T. Archiaciana*, d'Orbigny; but I think it is more likely to be an example of *T. ornata*. I have not been able to trace the specimen.

Types.—The specimens figured by Lycett are in the Museum of Practical Geology.

Distribution.—*Perna*-bed of Atherfield. Ferruginous Sands of Shanklin. Hythe Beds of Hythe, Lympne, and near Maidstone.

[1] 'Trans. Geol. Soc.,' ser. 2, vol. iv (1836), pp. 131, 338, pl. xiii, fig. 3.

Trigonia upwarensis, *Lycett*, 1875.

1875. Trigonia upwarensis, *Lycett*, p. 143, pl. xxiii, figs. 8, 9; pl. xxxix, fig. 4.
1883. — — *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 113.

Remarks.—This species is allied to *T. Archiaciana*, d'Orbigny, but the costæ are more numerous and have greater curvature near the anterior border. The costellæ on the area appear to be generally more numerous and more nearly perpendicular to the carina. The outline of the larger specimens appears to be more rounded than in *T. Archiaciana*.

Types.—In the Museum of Practical Geology. The specimen figured on Lycett's pl. xxxix is in the collection of Mr. J. F. Walker.

Distribution.—Lower Greensand of Upware.

Trigonia Archiaciana, *d'Orbigny*, 1844.

Additional Synonymy.

1866. Trigonia Archiaciana, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 380.
1875. — — *Lycett*, pp. 140, 202 (*partim*), not the figures.

Remarks.—It seems doubtful whether this species occurs in England; I have seen two specimens from the *Perna*-bed of Atherfield and Sandown, which may perhaps belong to it; but they are not sufficiently perfect for exact determination. The surface of the specimen from the Gault of Okeford Fitzpaine, figured by Newton,[1] has perished, so that I am unable to give any opinion as to its affinities.

Trigonia spinosa, *Parkinson*, 1811.

Additional Synonymy.

1875. Trigonia spinosa, *Lycett*, p. 136, pl. xxiii, fig. 10; pl. xxiv, figs. 8, 9; pl. xxviii, figs. 1, 2.
?1881. — — *J. Kiesow.* Schrift. d. nat. Gesellsch. in Danzig, vol. v, p. 413.

---

[1] 'Proc. Dorset Nat. Hist. and Antiq. Field Club.,' vol. xviii (1897), p. 96, pl. iii, fig. 16.

? 1885.	Trigonia spinosa,	*F. Nötling.*	Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 27, pl. iv, figs. 16, 17.
? Non 1837.	—	—	*F. Dujardin.* Mém. Soc. géol. France, vol. ii, p. 224.
— 1844.	—	—	*A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 154, pl. ccxcvii, figs. 1—5.
— 1850.	—	—	*d'Orbigny.* Prodr. de Pal., vol. ii, p. 161.

Types.—The type, from Blackdown, and the specimen figured by Sowerby, are in the British Museum.

The originals of Lycett's pl. xxiii, fig. 10, and pl. xxviii, fig. 1, 2, are in the Museum of Practical Geology; of pl. xxiv, fig. 8, in the Wiltshire Collection, Woodwardian Museum; of pl. xxiv, fig. 9, in the Williamson Collection, Manchester Museum.

Distribution.—Greensand of Blackdown.

Trigonia Vicaryana, *Lycett*, 1875.

1844.	Trigonia spinosa,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 154, pl. ccxcvii, figs. 1—5 (non *T. spinosa*, Park.).
1850.	—	—	*d'Orbigny.* Prodr. de Pal., vol. ii, p. 161.
1867.	—	—	*E. Guéranger.* Album Paléont. de la Sarthe, p. 14, pl. xviii, fig. 2.
1875.	—	Vicaryana,	*Lycett*, pp. 141, 203, pl. xxiii, fig. 7; pl. xxv, figs. 8, 9; pl. xxviii, fig. 4; pl. xl, figs. 3, 4.
? 1882.	—	pseudospinosa,	*P. de Loriol.* Gault de Cosne (Mém. Soc. Pal. Suisse, vol. ix), p. 99, pl. xii, figs. 12—14.
1896.	—	Vicaryana,	*A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 154.

Remarks.—This is relatively higher and shorter than *T. Archiaciana*, d'Orbigny, *T. upwarensis*, Lycett, and *T. ornata*, d'Orbigny. The costellæ on the area are more oblique to the carina than in *T. upwarensis*. The costæ are more numerous than in *T. ornata*.

T. Ludoviciæ, Briart and Cornet,[1] from Bracquegnies, is more produced posteriorly, it has fewer ribs anteriorly, and closer ribs posteriorly, than *T. Vicaryana*.

De Loriol figures a form from the Gault of Cosne, which he regards as *T. spinosa*, d'Orbigny, *non* Sowerby, and names *T. pseudospinosa*, but it seems to possess fewer and stronger costellæ on the area than *T. spinosa*, d'Orbigny, which is here considered to be identical with *T. Vicaryana*, Lycett.

Types.—From the Greensand near Sidmouth and Haldon; in the Museum of Practical Geology (Lycett's pl. xxv, fig. 8), and Mr. Vicary's collection (fig. 9).

[1] 'Descript. de la Meule de Bracquegnies' (1868), p. 65, pl. vi, figs. 6, 7.

Other figured specimens are in Mr. Vicary's collection (pl. xxiii, fig. 7—from Haldon, *not* Blackdown as stated by Lycett; and pl. xxviii, fig. 4), and in Mr. Meÿer's collection (pl. xl, figs. 3, 4).

Distribution.—Greensand of Haldon, Kingskerswell, and near Weymouth. Cenomanian of Dunscombe, Branscombe, and Beer Head (Meÿer's Beds 10, 11 and 12); and of Pinhay (Bed 10). Base of Chalk Marl (zone of *Schlœnbachia varians*) of Eggardon Hill, Chard, Chardstock, and Titherleigh (near Chard).

TRIGONIA FITTONI, *Deshayes*, 1842.

Additional Synonymy.

1866. TRIGONIA FITTONI, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 381, 386, pl. cxxviii, fig. 10.
1875. — — *Lycett*, p. 132, pl. xxiii, figs. 4, 5.
1897. — — *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 96, pl. iii, fig. 15.

Types.—In the École des Mines, Paris, from the Albian of Le Gaty, Epothémont, etc. (Aube). The specimens figured by Lycett are in the Museum of Practical Geology, and in the Wiltshire Collection, Woodwardian Museum. The example figured by Newton is in the British Museum.

Distribution.—Gault (zone i) of Folkestone. Zone of *Hoplites interruptus* of Okeford Fitzpaine.

TRIGONIA COSTIGERA, *Lycett*, 1879.

1879. *Lycett*, p. 205, pl. xli, fig. 17.

Type.—In the Museum of Practical Geology. This is the only specimen seen; it is very imperfectly preserved.

Distribution.—Cenomanian (Meÿer's Bed 10) of Dunscombe.

TRIGONIA PENNATA, *Sowerby*, 1819.

Additional Synonymy.

1828. TRIGONIA PENNATA, *Defrance.* Dict. Sciences nat., vol. lv, p. 297.
1866. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 387.
1875. — — *Lycett*, p. 133, pl. xxiv, figs. 4, 5; pl. xxxvii, fig. 4.

Types.—In the British Museum—from near Teignmouth. The specimens figured by Lycett are in Mr. Vicary's Collection, and in the British Museum (Cunnington Collection).

Distribution.—Cenomanian (Meÿer's Beds 10 and 11) of Dunscombe. Greensand of Haldon, Teignmouth, and Kingskerswell.

TRIGONIA SULCATARIA, *Lamarck.*

Additional Synonymy.

? 1840.	TRIGONIA SULCATARIA,	*H. B. Geinitz.*	Char. d. Schicht. u. Petref. sächsisch. Kreidegeb., pt. 2, pp. 54, x, pl. xxi, fig. 3.
? 1846.	—	—	*Geinitz.* Grundriss der Verstein., p. 444.
? 1846.	—	—	*A. E. Reuss.* Die Verstein der böhm. Kreideformat., pt. 2, p. 5.
1850.	—	—	*H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 158.
1850.	—	—	*G. P. Deshayes.* Traité Elém. de Conchyl., vol. ii, p. 259, pl. xxxiii, fig. 10.
1866.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 387.
1867.	—	—	*E. Guéranger.* Album Paléont. de la Sarthe, p. 14, pl. xviii, fig. 6.
? 1873.	—	—	*H. B. Geinitz.* Das Elbthalgeb. in Sachsen. (Palæontographica, vol. xx), pt. 1, p. 224, pl. xlix, figs. 13, 14.
1875.	—	—	*Lycett*, p. 135, pl. xxvi, fig. 8; pl. xxviii, fig. 3.

Remarks.—*T. maudensis*, Whiteaves,[1] *T. diversicostata*, Whiteaves,[2] and *T. Buchi*, Geinitz,[3] are allied forms; and so also is probably *T. subovalis*, Jimbo.[4]

Types.—The specimens figured by Lycett are in Mr. Vicary's Collection.

Distribution.—Cenomanian of Dunscombe. Greensand of Haldon and Kingskerswell.

[1] 'Mesozoic Fossils,' vol. i, pt. 3 ('Geol. and Nat. Hist. Survey Canada,' 1884), p. 230, pl. xxxi, fig. 2.

[2] Ibid., pt. 1 (1876), p. 68, pl. x, fig. 1.

[3] 'Das Elbthalgeb. in Sachsen,' pt. 1 (1873), p. 225, pl. xlix, figs. 15, 16.

[4] "Kreideformat. von Hokkaido" ('Palæont. Abhandl.,' vol. vi, 1894), p. 42, pl. viii, fig. 5.

TRIGONIA CUNNINGTONI, *Lycett*, 1875.

1875. *Lycett*, p. 146, pl. xxiii, fig. 11.

Type.—British Museum (Cunnington Collection).
Distribution.—Upper Greensand of Devizes.

Section 6.—BYSSIFERÆ.

TRIGONIA CARINATA, *Agassiz*, 1840.

Additional Synonymy.

1858.	TRIGONIA CARINATA,	*J. Vilanova-y-Piera.*		Mém. Geog.-agric. de Castellon, pl. iii, fig. 19.
1861.	—	—	*P. de Loriol.*	Invert. Foss. du Mt. Salève, p. 74.
1865.	—	—	*H. Coquand.*	Mon. Aptien de l'Espagne, p. 135.
1866.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 365.
1877.	—	—	*Lycett*, p. 179, pl. xxxv, figs. 3—6.	
1896.	—	—	*A. Wollemann.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 846.
1900.	—	—	—	Die Biv. und Gastrop. deutsch. u. holländ. Neoc. (Abhandl. d. k. preussisch, geol. Land. N. F., pt. 31), p. 86, pl. iv, figs. 6, 7.

Remarks.—*T. subcarinata*, Ébray,[1] (= *T. Heva*, Dollfuss) is an allied form, but with fewer costæ.

Types.—From the Neocomian of Hauterive. The specimens figured by Lycett are in the Museum of Practical Geology.

Distribution.—*Perna*-bed of Atherfield and Sandown. Hythe Beds of Hythe, Lympne, and Maidstone. Upper Greensand of Ventnor, Blackdown, Melbury (near Shaftesbury), and Potterne.

[1] 'Études géol. sur le départ. de la Nièvre' (1858), p. 200; Dollfuss, 'Bull. Soc. géol. France,' ser. 2, vol. xx (1863), p. 220, pl. ii; De Loriol, 'Gault de Cosne' (1882), p. 97, pl. xii, figs. 8—10.

Family—Mytilidæ, *Lamarck*.

Genus—Mytilus, *Linnæus*, 1758.

('Syst. Nat., ed. 10, p. 704.')

Mytilus inæquivalvis, *Sowerby*, 1836. Plate XV, figs. 7 *a*—*d*.

1836. Mytilus inæquivalvis, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 342, pl. xvii, fig. 16 (*non* Deshayes, 1838).
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 215.

Description.—Shell slightly inequivalve, compressed, triangular, expanded and rounded posteriorly; edges sharp except at the anterior part of the ventral margin. Dorsal margin slightly curved, ventral nearly straight. Umbones slightly curved, pointed; no carina; greatest convexity between the umbones and the postero-ventral extremity. Surface smooth except for faintly marked growth-lines.

Measurements:

	(1)	(2)
Umbo to postero-ventral extremity . .	42	31 mm.
Height (at right angles to greatest length) .	24	19 ,,
Thickness	13·5	11 ,,

(1), the Type; (2), in the British Museum.

Affinities.—This species seems to approach *M. Galliennei*, d'Orbigny,[1] but is more compressed near the postero-ventral edge, less regular in outline, and without ornamentation near the ventral border.

Type.—In the Bristol Museum. The only other specimen seen is in the British Museum.

Distribution.—Blackdown Greensand.

Mytilus, sp., *cf.* tornacensis, *d'Archiac*, 1847.

1847. Mytilus tornacensis, *A. d'Archiac*. Mém. Soc. géol. France, ser. 2 vol. ii, p. 307, pl. xv, fig. 3.
1847. — hainoensis, *P. de Ryckholt*. Elucubrat. paléont. (not seen).

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 273, pl. cccxxxix, figs. 1, 2. See also Geinitz, "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx), pt. 1 (1873), p. 213, pl. xlviii, figs. 1—3.

1852. Mytilus tornacensis, *P. de Ryckholt.* Mélanges Paléont., pt. 1 (Mém. cour. et Mém. des Sav. étrangers vol. xxiv), p. 150, pl. ix, fig. 7.
1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India vol. iii, p. 374.
1883. Modiola, sp. nov., *W. Keeping.* Foss., &c., Neoc., Upware and Brickhill, p. 118.

Remarks.—A single specimen described, but not named, by W. Keeping agrees closely with *M. tornacensis*, d'Archiac. The greater part of the shell has unfortunately disappeared except ventrally to the carina, where the characteristic crimp-like ornamentation is seen, but is rather finer than in Belgian specimens.

D'Orbigny[1] and some other authors have considered *M. tornacensis* to be identical with *M. Galliennei*, d'Orbigny, but the two forms seem to me quite distinct. The former (of which I have one specimen from Tournay, sent me by M. Piret, and also figures of a specimen in the Brussels Museum, kindly made by M. Rutot) is distinguished from the latter by (1) the more prominent, ridge-like, regular growth-lines;[2] (2) the presence of the crimp-like ornamentation near the dorsal margin as well as ventrally; (3) the less pointed umbonal region; (4) the curvature of the carina. I am doubtful whether this species should be referred to *Mytilus*.

Type.—From the Tourtia of Tournay.

Distribution.—Lower Greensand of Upware.

Genus—Modiola, *Lamarck*, 1799.

('Mém. Soc. Hist. Nat. Paris,' p. 87.)

Modiola æqualis, *Sowerby*, 1818. Plate XV, figs. 8 *a*—*c*, 9—14.

1818. Modiola æqualis, *J. Sowerby.* Min. Conch., vol. iii, p. 18, pl. ccx, fig. 2.
? 1842. — bipartita, *A. Leymerie.* Mém. Soc. géol. France, vol. v, p. 26, pl. ix, fig. 8 (non *bipartita*, Sowerby).
1844. Mytilus æqualis, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 265, pl. cccxxxvii, figs. 3, 4.
1845. — (Modiolus) æqualis, *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 248.
1850. — æqualis, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 81.
1854. Modiola æqualis, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 210.
1855. Mytilus æqualis, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 93.

[1] 'Prod. de Pal.,' vol. ii (1850), p. 165.

[2] In this respect d'Archiac's fig. 3 is not satisfactory; it was probably drawn from a worn specimen.

1858. Mytilus æqualis, *F. J. Pictet and E. Renevier.* Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 116, pl. xvi, fig. 2.
1865. — — *H. Coquand.* Mon. Aptien de l'Espagne, p. 143.
1868. — — *E. Eichwald.* Lethæa Rossica vol. ii, p. 531.
1867. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 496, 507.
1883. Modiola obesa, *W. Keeping.* Foss., &c., Neoc. Upware and Brickhill, p. 117, pl. vi, fig. 3.

? Non 1846. — æqualis, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 15, pl. xxxiii, fig. 10.
— 1866. — — *K. A. Zittel.* Die Bivalv. der Gosaugeb, pt. 2 (Denkschr. d. k. Akad. Wissen. Math.-nat. Cl. Wien, vol. xxv), p. 80 (p. 4 of reprint), pl. xi, fig. 4.
— 1882. — — *J. Kiesow.* Schrift. der nat. Gesell. in Danzig, vol. v, p. 240.
? — 1885. — — *F. Nötling.* Die Fauna der baltisch. Cenom. (Palæont. Abhandl., vol. ii), p. 24, pl. iv, fig. 1.

Description.—Shell ovate-oblong, rather short, rounded at the ends, convex, compressed posteriorly. Dorsal and ventral margins usually nearly parallel. Umbones obtuse, not terminal. Carina absent or very indistinct; greatest convexity of valve between the umbo and the postero-ventral extremity. A slight mesial groove produces a small sinus near the middle of the ventral margin. Surface smooth except for the presence of small concentric ridges, which are best marked anteriorly and postero-dorsally.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length . .	29	28	27	22·5	22	21	15 mm.
Height . .	14·5	15	12·5	12	11·5	10·5	9 ,,
Thickness . .	15	15	14	11	10	9·5	9 ,,

(1—7) all from the Crackers of Atherfield.

Affinities.—The young forms of *M. reversa*, Sowerby, are distinguished from this species by the greater obliquity of their ventral margins. *M. Fittoni*, d'Orbigny,[1] appears to differ from *M. æqualis* in the presence of a distinct carina with radial striæ in front of it, and also in its greater length.

Forbes and Morris considered that *M. Archiaci*, Leymerie,[2] and *M. bipartita*, Leymerie, *non* Sowerby, were identical with *M. æqualis*. Some of our specimens agree very closely with Leymerie's figures of the latter, but with the former the agreement is not quite so satisfactory; the figures given by d'Orbigny,[3] and by

[1] 'Prodr. de Pal.,' vol. ii (1850), p. 81.
[2] 'Mém. Soc. géol. France,' vol. v (1842), p. 8, pl. x, fig. 2.
[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1845), p. 291, pl. cccxliv, figs. 10—12.

Pictet and Campiche,[1] show a more elongate shell; the species is referred by these authors to *Lithodomus*.

M. cultor, Wollemann,[2] from the Hils-conglomerate of Brunswick, is closely allied; it appears to differ chiefly in having a more angular outline and a distinct carina.

Young specimens of *M. æqualis* are similar in form to *M. matronensis*, d'Orbigny,[3] but apparently somewhat longer.

I am unable to distinguish *M. obesa*, Keeping (from Upware), from *M. æqualis*; its somewhat greater inflation is, I think, due to crushing.

Types.—In the British Museum—internal casts from the Sandgate Beds of Parham Park. The type of *M. obesa*, Keeping, is in the Woodwardian Museum.

Distribution.—*Perna*-bed, Crackers, and Beds 35 and 36 (Fitton) of Atherfield. *Perna*-bed of Redcliff. Ferruginous Sands of Shanklin. Atherfield Beds of Sevenoaks and Peasmarsh. Hythe Beds of Maidstone. Sandgate Beds of Parham Park. Lower Greensand of Upware.

MODIOLA REVERSA, *Sowerby*, 1836. Plate XV, figs. 15, 16, 17 *a*, *b*, 18 *a*—*c*; Plate XVI, figs. 1, 2 *a*, *b*, 3.

1836. MODIOLA REVERSA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 342, pl. xvii, fig. 13.
? 1842. — LÆVIGATA, *H. B. Geinitz*. Char. der Schicht. und Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 78, pl. xx, fig. 35.
? 1843. — REVERSA, *H. B. Geinitz*. Die Verstein. von Kieslingswalda, p. 15, pl. iii, fig. 11.
1844. MYTILUS SEMIRADIATUS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 277, pl. cccxli, figs. 1, 2.
1850. MODIOLA REVERSA, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 168 (*partim*).
1850. MITYLUS REVERSUS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 165.
1854. MODIOLA REVERSA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 211.
1867. MYTILUS (MODIOLA) REVERSUS, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 510.
1868. — REVERSUS, *A. Briart and F. L. Cornet*. Descript. Min. géol. et Pal. de la Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 53, pl. iv, figs. 9, 10.

---

[1] "Foss. Terr. Crét. Ste. Croix" ('Mater. Pal. Suisse,' ser. 3, 1866), pp. 517, 524, pl. cxxxiv fig. 8.

[2] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xlviii (1896), p. 843, pl. xxi, f. 4; and 'Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc.' (1900), p. 65.

[3] 'Pal. Franç. Terr. Crét., vol. iii (1844), p. 269, pl. cccxxxvii, figs. 14—16.

? 1873. Modiola reversa, var., *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 216, pl. xlviii, fig. 9.

Non 1844. Mytilus reversus, *A. d'Orbigny.* Pal. Franç. Terr. Cret., vol. iii, p. 264, pl. cccxxxvii, figs. 1, 2.

? 1846. Modiola reversa, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 15, pl. xxxiii, fig. 9.

Description.—Shell elongate-oval, extremities rounded; median part of shell—from the umbo to the posterior extremity—inflated and slightly curved; dorsal part compressed and somewhat extended. Ventral to the inflated part is a shallow depression. Hinge margin forms an obtuse angle with the oblique and slightly convex posterior margin. Ventral border sinuous. Umbones obtuse; no carina. Ornamentation consists of concentric ridges, often sharply marked, sometimes discontinuous and rather irregular; between these are seen, in some specimens, much finer ridges. A bundle of fine radial ribs extends from the umbo to the ventral sinuosity and occupies the greater part of the shallow depression; occasionally fine close-set radial lines are seen on other parts of the shell.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	71	70	58	54	34	21	mm.
Greatest diameter perpendicular to length . . .	29	30	26	22	15	12	„
Thickness	27	—	22	21	—	—	„

(1—6) all from Blackdown.

Affinities.—The form figured by d'Orbigny as *M. reversus* (Sowerby), but afterwards separated as *M. Fittoni*, d'Orbigny,[1] appears to differ from Sowerby's species in the possession of a distinct carina, and in having the umbones placed less anteriorly.

M. typica (Forbes),[2] especially as represented by the forms from Gosau, is closely allied to *M. reversa*.

M. albensis (d'Orbigny)[3] is very near to *M. reversa*, but is perhaps distinguished by the somewhat longer and less curved anterior margin.

For the relation of this form to *M. ligeriensis* (d'Orbigny) see below.

Type.—In the Bristol Museum, from Blackdown.

[1] For the synonymy of this species see Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' (Matér. Pal. Suisse, ser. 4, 1867), p. 495.

[2] 'Trans. Geol. Soc.,' ser. 2, vol. vii (1846), p. 152, pl. xiv, fig. 4; Zittel, "Die Bivalv. der Gosaugeb." ('Denkschr. d. k. Akad. Wissensch. Math.-nat. Classe,' vol. xxv, 1866), pt. 2, p. 78 (p. 2 of reprint), pl. xi, fig. 5; Stoliczka, 'Cret. Fauna S. India,' vol. iii (1871), p. 377, pl. xxiii, figs. 12—15.

[3] Pictet and Campiche, op. cit., p. 504, pl. cxxxiv, fig. 1.

Distribution.—Greensand of Blackdown. Greensand (chert beds) of Woodlands Covert, Great Haldon. Upper Greensand of Black Ven and Devizes. Cenomanian (Meÿer's Bed 12) of Dunscombe. ? Gault of Black Ven.

Modiola ligeriensis (*d'Orbigny*), 1844. Plate XVI, figs. 4 *a*, *b*, 5 *a*, *b*, 6.

1844.	Mytilus ligeriensis,	*A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 274, pl. cccxl, figs. 1, 2.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 165.
1867.	—	—	*E. Guéranger.*	Album Paléont. de la Sarthe, p. 17, pl. xxii, figs. 2—4.
1867.	Modiola ligeriensis,	*F. J. Pictet and G. Campiche.*		Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 509.
? 1876.	—	—	*D. Brauns.*	Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi, p. 374.
? 1883.	—	typica,	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat., iii. Die Iserschichten, p. 106, fig. 73.

? Non 1846. Mytilus (Modiola) ligeriensis, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 16, pl. xxxiii, fig. 3.

Measurements:

	(1)	(2)
Length	89	60 mm.
Greatest height (perpendicular to length)	40	25 ,,
Thickness	34	24 ,,

(1) and (2) from the *Perna*-bed of Atherfield.

Affinities.—This species agrees with *M. reversa*, Sowerby, and seems to be distinguished only by the crimp-like ornament in the spaces between the ribs; this is usually best developed on the dorsal and postero-ventral parts of the valves, and seems always to be absent on the anterior region. The specimens of *M. reversa* from Blackdown do not show that ornament,[1] and its absence can scarcely be explained by imperfect preservation, since other finer ornament is clearly shown on some specimens. On the other hand, the possibility of the two species being identical is supported by the great variability in the development of the crimp-like ornament in *M. ligeriensis*. On some specimens from the Cenomanian of Orbiquet it is very faint, but on one from Le Mans (preserved in the École des Mines, Paris) the crimp-ornament is stronger and more continuous than the concentric ornament.

[1] One specimen seems to show a very faint trace of it near the hinge-margin.

Distribution.—*Perna*-bed of Atherfield. Upper Greensand of Potterne. Chloritic Marl of Warminster. ? Cenomanian of Wilmington (fragment only seen).

Modiola rugosa, *Römer*, 1836.

1836.	Modiola rugosa, *F. A. Römer.*		Die Verstein. nord-deutsch. Oolithengeb., p. 93, pl. v, f. 10.
1841.	—	—	Die Verstein. nord-deutsch. Kreidegeb., p. 67.
1850.	Mitylus subrugosus, *A. d'Orbigny.*		Prodr. de Pal., vol. ii, p. 81.
1867.	Mytilus (Modiola) rugosus, *F. J. Pictet and G. Campiche.*		Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 508.
1896.	Modiola rugosa, *A. Wollemann.*		Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 845.
1900.	—	—	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preuss. geol. Land., N. F., pt. 31), p. 64.

Remarks.—A specimen 45 mm. long, with the umbones broken, is in the Leckenby Collection (Woodwardian Museum), and belongs, I think, to this species.

Type.—From the Hilsthon of the Elligser Brink.

Distribution.—Crackers of Atherfield.

Modiola subsimplex (*d'Orbigny*), 1850. Plate XVI, figs. 7, 8, 9 *a*, *b*, 10 *a*, *b*.

1842.	Modiola simplex, *G. P. Deshayes.*		In A. Leymerie, Mém. Soc. géol France, vol. v, pp. 8, 26, pl. vii, fig. 8 (non *Mytilus simplex*, Defrance, 1824; Passy, 1832).
1844.	Mytilus	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 269, pl. cccxxxviii, figs. 1—4.
1845.	Mytilus (Modiolus) simplex, *E. Forbes.*		Quart. Journ. Geol. Soc., vol. i, p. 248.
1850.	Mitylus subsimplex, *A. d'Orbigny.*		Prodr. de Pal., vol. ii, p. 81.
1852	Mytilus gurgitis, *F. J. Pictet and W. Roux.*		Moll. Foss. Grès verts de Genève, pp. 481, 551, pl. xl, fig. 2.
1854	Modiola simplex, *J. Morris.*		Cat. Brit. Foss., ed. 2, p. 211.
1855.	Mytilus subsimplex, *G. Cotteau.*		Moll. Foss. de l'Yonne, p. 94.
1858.	—	— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 114, pl. xvi, fig. 3.
1861.	—	— *P. de Loriol.*	Anim. Invert. Foss. Mt. Salève, p. 92, pl. xi, fig. 9.

1865. Mytilus subsimplex, *H. Coquand.* Mon. Aptien de l'Espagne, p. 143.
1867. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pp. 493, 507.
1882. Modiola sub-simplex, *P. de Loriol.* Gault de Cosne (Mém. Soc. Pal. Suisse, vol. ix), p. 81, pl. ix, fig. 17.
1884. Mytilus simplex, *O. Weerth.* Die Fauna d. Neoc. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 47.
1895. — — *G. Maas.* Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 266.
1896. Modiola simplex, *A. Wollemann.* Zeitschr. der deutsch. geol. Gesellsch., vol. xlviii, p. 844.
1897. Mytilus — *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 89, pl. iii, fig. 13.
1900. Modiola subsimplex, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms. (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 62.

Description.—Shell elongate, straight or curved, somewhat compressed. Anterior extremity narrow; posterior part somewhat expanded. Hinge-margin straight, long; posterior margin relatively short, curved, oblique; ventral margin concave. A rounded ridge extends from the umbo to the postero-ventral extremity; in front of this is a shallow depression. Surface smooth except for faint growth-lines.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length (greatest)	51	48	44	34	30	mm.
Height (at right angles to greatest length)	16	15	14	13	11	„
Thickness	—	12·5	11	10	7·5	„

(1)—(5) all from the Crackers of Atherfield.

Affinities.—This species is very near to, and perhaps identical with, *M. siliqua*, Mathéron;[1] but the latter is said to have the anterior extremity more obtuse.

M. semiornatus, d'Orbigny, has the concentric ornament more pronounced on the dorsal part of the shell.

M. rectior, Wollemann,[2] from the Hils-conglomerate of Brunswick, is very

[1] 'Catal. Foss. Bouches-du-Rhone' (1842), p. 178, pl. xxviii, figs. 5, 6; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 274, pl. cccxxxix, figs. 3, 4; and 'Prodr. de Pal.' (1850), p. 165; Geinitz, 'Quadersandst. in Deutschland' (1850), p. 168, pl. x, fig. 14; Zittel, 'Die Bivalv. der Gosaugeb.,' pt. 2 (1866), p. 81 (p. 5 reprint), pl. xi, fig. 3; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix (1867), p. 510; Geinitz, 'Das Elbthalgeb. in Sachsen,' pt. 1 (1873), p. 215, pl. xlvii, fig. 3, pt. 2, pl. xv, fig. 4; Böhm, "Kreidebild. Fürbergs," etc. ('Palæontographica,' vol. xxxviii, 1891), p. 81, pl. iii, fig. 29; Müller, "Mollusk. Untersen. Braunschweig und Ilsede" ('Abhandl. d. k. preuss. geol. Land.,' N. F., pt. 25, 1898), p. 46, pl. v, fig. 14.

[2] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xlviii (1896), p. 844, pl. xxi, f. 6; and 'Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc.' (1900), p. 63.

closely related to *M. subsimplex*, but seems to differ in being less convex between the umbo and the posterior extremity, and in having the ventral margin straighter and the posterior more rounded.

Types.—The type comes from the Neocomian of Ville-sur-Terre. The specimen referred to by Forbes is in the Museum of the Geological Society. The specimen figured by Newton is in the British Museum.

Distribution.—*Perna*-bed and Crackers of Atherfield. Atherfield Beds of Sevenoaks. Upper Greensand of Devizes. Gault of Folkestone, Black Ven, and Okeford Fitzpaine. ? Greensand of Blackdown.

MODIOLA FLAGELLIFERA, *Forbes*, 1846. Plate XVII, figs. 1, 2.

? 1842. INOCERAMUS SILIQUA, *P. Mathéron*. Catal. Foss. Bouches-du-Rhône, p. 174, pl. xxv, fig. 6.

1846. MYTILUS (MODIOLUS) FLAGELLIFERUS. *E. Forbes*. Trans. Geol. Soc., ser. 2, vol. vii, p. 152, pl. xvi, fig. 9.

1850. MITYLUS FLAGELLIFERUS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 247.

? 1863. MYTILUS (MODIOLUS) FLAGELLIFERUS, *D. Stur*. Jahrb. d. k.-k. geol. Reichsanst., vol. xiii, p. 55.

1866. MODIOLA FLAGELLIFERA, *K. A. Zittel*. Die Bivalv. d. Gosaugeb. (Denkschr. d. k. Akad. der Wissensch. Math-nat. Classe, vol. xxv), pt. 2, p. 82 (p. 6 of reprint), pl. xii, fig. 2.

1867. — FLAGELLIFERUS, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 513.

1871. — FLAGELLIFERA, *F. Stoliczka*. Pal. Indica, Cret. Fauna S. India, p. 379, pl. xxiv, figs. 1, 2.

? 1873. MYTILUS (MODIOLA) FLAGELLIFERA. *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 2, p. 55, pl. xv, fig. 5.

1897. MODIOLA FLAGELLIFERA, *A. Fritsch*. Stud. im Geb. der böhm. Kreidef. vi, Die Chlomek. Schicht., p. 59, fig. 69.

Description.—Shell very elongate, slightly curved, compressed, with knife-like edges; somewhat enlarged posteriorly. Dorsal margin almost straight, and nearly parallel with the slightly concave ventral margin. Umbones obtuse, nearly terminal, with a faintly marked oblique carina extending to the postero-ventral extremity. Ornamentation consists of flagelliform ribs, which are broad near the dorsal margin, and are directed obliquely backwards. At about half their length they curve rapidly, diminish in size, bifurcate, and often have smaller ribs intercalated: the ribs taper at the carina, ventral to which the shell is marked with growth-lines only, or is nearly smooth.

Measurements :

	(1)	(2)	
Length	77	102	mm.
Height	25	22	,,

(1) and (2) from Devizes.

Affinities.—This species belongs to a section of *Modiola* characteristic of the Jurassic rocks, of which *M. Sowerbiana* (d'Orbigny) [= *M. plicata*, Sowerby], *M. perplicata* (Etallon), *M. Medus* (d'Orbigny), and *M. icaunensis* (de Loriol) are well-known representatives.

I have seen only three English examples, and these, although in the form of internal casts, seem to agree perfectly with the types of *M. flagellifera*, Forbes (from Pondicherry), with which I have compared them. Zittel has referred to this species a form found in the Gosau Beds, of which I have seen one specimen collected by Mr. H. Kynaston from Finstergraben, and now preserved in the Woodwardian Museum; this also agrees with the Forbes' types.

The specimen figured by Mathéron as *Inoceramus siliqua* is probably an imperfect example of this species. *Modiola Gillieroni* (Pictet and Campiche),[1] from the Valangian of Presle (near Bienne) and Cinquétral, appears to differ from *M. flagellifera* in having fewer ribs dorsally, and in the general absence of bifurcation as they curve on approaching the carina.

M. Baini, Sharpe,[2] from Sunday River (South Africa), apparently differs from *M. flagellifera* in having the ribs continued ventral to the carina, and perhaps also in having a more elongate shell.

M. Ebrayi, de Loriol,[3] is probably another related form, but at present is imperfectly known.

Types.—From the Valudayoor Group of Pondicherry, preserved in the Museum of the Geological Society of London (No. 10631); these are also figured by Stoliczka.

Distribution.—Upper Greensand of Devizes and Black Ven.

MODIOLA UNDULATA (*Forbes*). Plate XVII, fig. 3.

1845. CYPRICARDIA? UNDULATA, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 242, pl. iii, fig. 1.

1848. CYPRICARDIA UNDULATA, *H. G. Bronn*. Index Palæont., vol. i, p. 387.

[1] "Foss. Terr. Crét. Ste. Croix" ('Mater. Pal. Suisse,' ser. 4), 1867, p. 503, pl. cxxxiii, figs. 9, 10.

[2] 'Trans. Geol. Soc.,' ser. 2, vol. vii (1856), p. 193, pl. xxii, figs. 2, 3.

[3] "Faune du Gault de Cosne" ('Mém. Soc. Pal. Suisse,' vol. ix, 1882), p. 80, pl. ix, figs. 18—20 (especially fig. 20).

1850. Mytilus undulatus, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 119.
1854. Cypricardia undulata, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 199.
1867. Mytilus (Modiola) undulatus, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 508.
1871. Modiola undulata, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 372.

Description.—Shell moderately elongate, compressed, enlarged posteriorly. Dorsal margin nearly straight; ventral oblique; anterior rounded. Umbones not terminal, with a sharply marked curving carina extending to the postero-ventral extremity. From the dorsal margin broad ribs start and are directed posteriorly, afterwards curving to join the carina, where they end. Ventral to the carina the shell is marked by fine lines only.

Measurements:

Length	33 mm.
Height (at the posterior end)	18 „

Affinities.—This is distinguished from *M. flagellifera*, Forbes, and *M. Gillieroni* (Pictet and Campiche) by the shorter shell, the carina, the small curvature of the ribs, and the absence of bifurcation in them.

The generic position of this species cannot be stated with certainty, since the type specimen is the only example seen and the interior is unknown.

Type.—In the Museum of the Geological Society of London (No. 2088).

Distribution.—Atherfield Clay of Atherfield.

Sub-genus—Brachydontes, *Swainson*, 1840.

('Treatise on Malacology,' p. 384.)

Modiola (Brachydontes) Guerangeri ? (*d'Orbigny*), 1844. Plate XVII, figs. 4, 5 *a*—*c*.

1844. Mytilus Guerangeri, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 282, pl. cccxlii, figs. 7—9.
1850. Mytilus — *d'Orbigny*. Prodr. de Pal., vol. ii, p. 166.
1862. Brachydontes Guerangeri, *J. G. Chenu*. Manuel de Conchyl., vol. ii, p. 154, fig. 762.
1867. Mytilus Guerangeri, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 509.
1867. — — *E. Guéranger*. Album Paléont. de la Sarthe, p. 17, pl. xxiii, fig. 3.
1871. Modiola Guerangeri, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 373 (*Brachydontes*).

Remarks.—Two incomplete specimens in Mr. Meÿer's collection agree with *M.* (*Brachydontes*) *Guerangeri*, from the Cenomanian of Le Mans, except in having finer ribs. Not having seen the type or other French specimens of *M. Guerangeri* I am unable to refer these examples definitely to that species. The ribbing on the ventral surface is clearly shown, and separates this form from *M. divaricata*, d'Orbigny.[1]

A specimen from the Greensand of Haldon, in Mr. Vicary's collection (pl. xvii. fig. 4), agrees with *M. Guerangeri*, especially with the example figured by Guéranger, except in the absence of the fine ribbing on the ventral surface; this difference may be due to imperfect preservation. The shell tapers more rapidly toward the umbones than in *M. divaricata*.

Distribution.—Greensand of Haldon. Cenomanian (Meÿer's Beds 10 and 12) of Dunscombe.

Modiola (Brachydontes) vectiensis, sp. nov. Plate XVII, figs. 6 *a*, *b*, 7 *a*—*c*, 8.

Description.—Shell small, rather short, inflated, expanded, and compressed posteriorly, extremities rounded. Ventral margin with a sinus produced by a mesial depression. Umbones obtuse, not terminal. Ornamentation consists of many strong and somewhat irregular ribs, which cover the entire surface and generally bifurcate toward the margin of the valve.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	14	14	13·5	12·5	9	mm.
Height	7·5	8	8	8	5	„
Thickness	6	—	—	—	—	„

(1), (5) from the Crackers, Atherfield.
(2) from the *Perna*-bed, Redcliff.
(3) from the Atherfield Beds, Littleton Pit, near Guildford.
(4) from the Atherfield Beds, East Shalford.

Affinities.—The smaller forms of this species resemble *M. striato-costata* (d'Orbigny), but possess stronger and less regular ribs, and are without the concentric ribs.

M. morinicus[2] (de Loriol) is also similar, but has more regular ribs, which do not bifurcate, and some parts of the shell are without ribs.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 275, pl. cccxl, figs. 3, 4; 'Prodr. de Pal.,' vol. ii (1850), p. 246; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' (1867), p. 511.

[2] De Loriol and Pellat, 'Portlandien de Boulogne-sur-Mer' ('Mém. Soc. Phys. et d'Hist. Nat. de Genève,' vol. xix, 1866), p. 91, pl. ix, fig. 4.

M. pedernalis, Römer,[1] is a larger species with finer ribs, and the anterior part of the shell nearly smooth.

Distribution.—*Perna*-bed of Redcliff. Crackers of Atherfield. Atherfield Beds of East Shalford, Peasmarsh, Sevenoaks, and (ferruginous nodules) Littleton Pit, near Guildford.

Modiola (Brachydontes) striato-costata (*d'Orbigny*), 1844. Plate XVII, figs. 9 *a*, *b*, 10 *a*, *b*, 11 *a*—*c*.

1844. Mytilus striato-costatus, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii. p. 281, pl. cccxlii, figs. 4—6.
1848. Modiola striato costata, *H. G. Brown*. Index Palæont., vol. i, p. 739.
1850. Mitylus striato-costatus, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 166.
1867. Modiola striato-costatus, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 510.
1871. — striato-costata, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 373.

Description.—Shell small, oblong or ovate-oblong, short, inflated, somewhat expanded, and also rounded and compressed posteriorly, ventral margin slightly sinuous. Umbones not quite terminal. No carina; dorsal and ventral to a line between the umbones and the posterior extremity the valves are sharply compressed. Ornamentation consists of numerous fine radial ribs separated by narrow grooves and covering the entire surface; the ribs curve toward the dorsal margin. The radial ribs are crossed at intervals by concentric ridges.

Measurements:

	(1)	(2)	(3)	(4)	(5)	
Length	9	8	8	7	5·5	mm.
Height	6	5	4·5	4·25	3·5	,,
Thickness . . .	—	4	4·75	5	—	,,

(1) to (5) from Blackdown.

Affinities.—The relation of this species to *M. vectiensis* is given above. It seems to approach closely the form described by Pictet and Campiche[2] as *Lithodomus prestensis*.

Distribution.—Blackdown Greensand.

[1] 'Die Kreidebild. von Texas' (1852), p. 53, pl. vii, fig. 11.

[2] "Foss. Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 4, 1867), p. 522, pl. cxxxvi, figs. 2—4.

Modiola, sp.

1883. Modiola pedernalis (?), *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 117, pl. vi, fig. 2.

A portion of a left valve with the surface abraded, from the Lower Greensand of Upware, was regarded by Keeping as probably *M. pedernalis*, Römer. The imperfect character of the specimen makes this reference very doubtful. The shell also resembles *M. autissiodorensis*, Cotteau, from the Portlandian.[1]

Genus—Crenella, *Brown*, 1827.

('Illust. Conch. Great Britain and Ireland,' pl. xxxi, figs. 12—14; ed. 2 (1844), p. 75, pl. xxiii, figs. 12—14.)

Crenella bella (*Sowerby*), 1836. Plate XVII, figs. 12 *a*, *b*, 13 *a*—*d*.

1836. Modiola bella, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, pp. 113, 158, 336, pl. xi, fig. 9.
1844. Mytilus Cornuelianus, *A. d'Orbigny*. Pal. Franç. Terr. Crét, vol. iii, p. 268, pl. cccxxxvii, figs. 10—13.
1845. — (Modiolus) bellus, *E. Forbes*. Quart. Journ Geol. Soc, vol. i, p. 248.
1850. Mitylus Cornuelianus, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 81.
1850. — bella, *d'Orbigny*. Ibid., p. 138.
1854. Modiola bella, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 210.
1855. Mytilus Cornuelianus, *G. Cotteau*. Moll Foss. de l'Yonne, p. 93.
1858. — bellus, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 113, pl. xv, fig. 10.
1867. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 502.
1869. — — *P. de Loriol and V. Gilliéron*. Mon. de l'Étage Urgonien Infér. du Landeron (Mém. Soc. Helvet. Sci. Nat., vol. xxiii), p. 17, pl. i, fig. 15.
1871. Modiola bella, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 372 (*? Crenella*).
1895. Mytilus Cornuelianus, *G. Maas*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 266.
1896. Modiola Cornueliana, *A. Wollemann*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlviii, p. 844.
1900. — bella, *A. Wollemann*. Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms. (Abhandl. d. k. preuss. geol. Land., N. F., pt. 31), p. 69.

[1] De Loriol and Cotteau, 'Mon. l'Étage Portlandien de l'Yonne' (1868), p. 189, pl. xii, fig. 8.

Description.—Shell subquadrate or oval, short, inflated—especially anteriorly and between the umbo and the postero-ventral extremity; on each side of this line the shell is compressed, and on the ventral side it is flattened. Hinge-margin relatively short; posterior margin curved, oblique; ventral long, nearly straight. Postero-ventral angle rounded. Umbo prominent, extending beyond the short anterior margin. Ornamentation consists of numerous fine regular radial ribs, crossed by finer concentric ribs, which are best marked on the dorsal part of the valves; also at intervals a few well-marked growth-lines.

Measurements:

	(1)	(2)	(3)	
Length . . .	16 .	14 .	13	mm.
Height . . .	11 .	9 .	8·5	,,
Thickness . . .	13·5 .	12·5.	11	,,

(1—3) all from Atherfield.

Affinities.—This is distinguished from the other Cretaceous species[1] by its more quadrate outline. It may, perhaps, belong to the sub-genus *Rhomboidella*, Monterosato.

Types.—I have not seen the type; it came from the Hythe Beds, near Hythe.

Distribution.—*Perna*-bed of Atherfield and Redcliff. Crackers of Atherfield. Hythe Beds near Hythe, and near Maidstone.

Genus—Lithodomus, *Cuvier*, 1817.

('Le Règne Animal,' vol. ii, p. 471.)

Lithodomus rugosus? *d'Orbigny*, 1845. Plate XVII, figs. 14 *a*, *b*.

1845.	Lithodomus rugosus,	*A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 294, pl. cccxlvi, figs. 1—3.
1850.	—	—	—	Prod. de Pal., vol. ii, p. 166.
1867.	—	—	*E. Guéranger.*	Album Paléont. de la Sarthe, p. 18, pl. xxiii, figs. 18—20.
1873.	—	—	*H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 219, pl. li, figs. 24—26.

Description.—Shell elongate, oval, subcylindrical, dorsal and ventral margins nearly parallel, extremities rounded. Surface with strongly marked growth-lines. Umbones not terminal.

[1] *C. concentrica*, Gabb; *C. elegantula*, Meek and Hayden; *C. sericea*, Conrad; *C. granulato-cancellata* (Römer); *C. inflata* (Müll.).

Measurements:

Length	28 mm.
Height	12 „

Affinities.—This species approaches *L. oblongus*, d'Orbigny, and *L. alpinus*, Zittel.

Remarks.—The three specimens seen are imperfectly preserved, and the radial ornament, described by d'Orbigny as occurring on the antero-ventral part of the valves, is not shown.

Distribution.—Cenomanian (Meÿer's Bed 10) of Dunscombe.

Family—DREISSENSIIDÆ, *Gray.*

Genus—Septifer, *C. A. Récluz*, 1848.

('Rev. Zool.,' p. 275.)

Septifer lineatus (*Sowerby*), 1836. Plate XVIII, figs. 1—12.

? 1820.	Pinnites ungulatus, *E. F. Schlotheim.*	Die Petrefactenkunde, p. 304.
1836.	Modiola lineata, *J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 129, 338, pl. xiv, fig. 2 (non *Mytilus lineatus*, Gmelin, 1789).
1839.	— angusta, *F. A. Römer.*	Die Verstein. norddeutsch. Oolithengeb. Nachtrag, p. 33, pl. xviii, fig. 36 (non *M. angusta*, Deshayes, 1824).
? 1840.	— Cottæ, *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs Kreidegeb., pt. 2, p. 56, pl. x, fig. 5.
1841.	— angusta, *F. A. Römer.*	Die Verstein. norddeutsch. Kreidegeb., p. 66.
? 1841.	Mytilus Cottæ, *Römer.*	Ibid., p. 66, pl. viii, fig. 18.
1842.	— Cuvieri, *P. Mathéron.*	Cat. Foss. des Bouches-du-Rhone, p. 179, pl. xxviii, figs. 9, 10.
? 1843.	— Cottæ, *H. B. Geinitz.*	Die Verstein. von Kieslingswalda, p. 15.
1844.	— lineatus, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 266, pl. cccxxxvii, figs. 7—9.
? 1844.	Modiola granulosa, *V. Potiez and A. Michaud.*	Galerie des Moll., vol. ii, p. 132, pl. liv, fig. 10.
1845.	Mytilus (Modiolus) asper, *E. Forbes* (non *Sowerby*).	Quart. Journ. Geol. Soc., vol. i, p. 248.
? 1846.	— Cottæ, *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 14, pl. xxxiii, fig. 4.
1848.	Modiola lineata, *H. G. Bronn.*	Index Palaeont., vol. i, p. 737.
1850.	Mitylus sublineatus, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, pp. 81, 119.
? —	— subangustus, *d'Orbigny.*	Ibid., p. 81.

1850. Mitylus peregrinus, *d'Orbigny*. Ibid., p. 165.
— — Cuvieri, *d'Orbigny*. Ibid., p. 246.
— — Cottæ, *d'Orbigny*. Ibid., p. 246.
— Modiola quadrata, *J. de C. Sowerby*. In F. Dixon, Geol. Sussex, p. 347 [p. 382 of ed. 2], pl. xxviii, fig. 13.
1852. Mytilus Cottæ, *P. de Ryckholt*. Mélanges Paléont., pt. 1 (Mém. cour. et Mém. des Sav. étrangers, vol. xxiv), p. 147.
— — ciplyanus, *de Ryckholt*. Ibid., p. 152, pl. ix, figs. 12, 13.
1852. Modiola lineata, *C. G. Giebel*. Deutschl. Petref., p. 379 (*partim*).
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 210.
1852. Mytilus Orbignyanus, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 479, pl. xxxix, fig. 9.
1857. — sublineatus, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 93.
1858. — — *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien de la Perte du Rhône (Matér. Pal. Suisse, ser. 1), p. 111, pl. xv, figs. 8, 9.
1861. — — *P. de Loriol*. Anim. Invert. Foss. du Mt. Salève, p. 92.
1864. — spathulatus, *H. Seeley*. The Geologist, vol. vii, p. 53.
1865. — Cuvieri, *H. Coquand*. Mon. Aptien de l'Espagne, p. 142.
1867. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 491.
1867. — Cottæ, *Pictet and Campiche*. Ibid., p. 511.
1869. — Cuvieri, *P. de Loriol and V. Gilliéron*. Mon. de l'Étage Urgon. inf. de Landeron (Mém. Soc. Helvet. Sci. Nat., vol. xxiii), p. 16, pl. i, fig. 14.
? 1870. Modiola, cf. lineata, *F. Römer*. Geol. von Oberschles., p. 333.
1871. Mytilus Cottæ, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 373, No. 56 (*Septifer?*).
1873. Modiola Cottæ, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 214, pl. xlviii, figs. 4—8.
1876. — (Septifer?) Cottæ, *D. Brauns*. Die Senon. Mergel des Salzberges (Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi), p. 375.
1889. Mytilus Cottæ, *A. Fritsch*. Stud. im Geb. der böhm Kreidef. iv. Die Teplitzer Schicht., p. 79, fig. 66.
1896. Modiola angusta, *A. Wollemann*. Zeitschr. der deutsch. geol. Gesellsch., vol. xlviii, p. 844.
1897. — Cottæ, *R. Leonhard*. Die Fauna der Kreidef. von Oberschles. (Palæontographica, vol. xliv), p. 27.
1897. — — *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 380, pl. xxvii, figs. 9—12.
? 1898. Mytilus (Septifer) lineatus, *A. Fritsch*. Stud. im Geb. der böhm. Kreidef. vi. Die Chlomeker Schichten, p. 57, fig. 65.
1898. Septifer lineatus, *G. Müller*. Die Mollusk. Untersen. von Braunschweig und Ilsede, pt. 1 (Abh. d. k. preuss. geol. Land., N. F., pt. 25), p. 48, pl. vii, fig. 2.

1899. Modiola Cottæ, *A. Hennig.* Bihang till k. Svenska Vet.-Akad. Handl., vol. xxiv, p. 13, pl. i, figs. 16—19.

1900. — Cuvieri, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preuss. geol. Land., N. F., pt. 31), p. 68.

Non 1847. Mytilus lineatus, *J. Müller.* Petref. Aachen. Kreidef., pt. 1, p. 34.

— 1889. Septifer lineatus, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 216, pl. xxv, figs. 10—13 (these figures are enlarged three times).

Description.—Shell thin, ovate-oblong, inflated, regularly convex from the umbo to the posterior extremity, more or less compressed at right angles to its greatest length (dorso-ventrally); slightly curved or occasionally straight. Dorsal margin slightly convex. Posterior extremity well rounded, a little expanded. Antero-ventral margin slightly concave, sometimes straight. Umbones small, curved, terminal. Carina faintly marked near the umbo, absent elsewhere. Antero-ventral face of the shell flattened or concave, postero-dorsal part regularly convex.

Ornamentation consists of fine but well-marked radial ribs, crossed by rather less distinct concentric ribs, giving a cancellate appearance; the radial ribs are serrate or granular where crossed by the concentric ribs. At intervals fairly strong growth-lines occur. An oval area below the umbones is without radial ribs, and shows only lines of growth.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Umbo to posterior extremity . .	49	42	42	41	37	34	32	29	36	28	mm.
Greatest diameter at right angles to preceding . . .	18	15	14	14·5	14	12	12	12	15	11	,,
Thickness . .	29	25	23	26	22	20·5	15	15·5	21	16	,,

(1—3, 6) from the Hythe Beds, Lympne.
(4) ,, Chalk Marl, Chardstock.
(5) ,, ,, Kempstone Rocks.
(7) ,, ,, Dunscombe.
(8) ,, ,, Titherleigh.
(9, 10) ,, Chalk Rock, Cuckhamsley.

Affinities.—The specimens figured by Geinitz as *M. Cottæ* in 'Das Elbthalgebirge in Sachsen' agree perfectly with our examples from the Cenomanian. The figures of *M. Cottæ* given by earlier authors appear to represent imperfect or crushed specimens, and I follow Geinitz, who was probably acquainted with the originals, in regarding them as the examples of *M. Cottæ.*

Modiola angusta, Römer, is considered by Wollemann to be identical with *M. lineata;* I have seen no examples of it.

Modiola quadrata, Sowerby, from the Upper Chalk, is, I believe, only a somewhat crushed example of this species, similar to the one figured on our Pl. XVIII, fig. 12.

Holzapfel considers that the forms from the Aachen Greensand, originally described by Müller as *Mytilus lineatus* and *M. scalaris*, should be referred to *M. lineatus*, Sowerby. The Aachen species is very variable, and I am greatly indebted to Prof. Holzapfel for the loan of six specimens which vary in their greatest length from 9·5 to 15 mm.[1] The Aachen shell is clearly distinct from our species; it is more curved, more irregular, smaller, and with the radial ribs more strongly marked and not crossed by concentric ribs, so that the cancellate appearance is not seen.

The form figured as *Mytilus ciplyanus* by de Ryckholt,[2] from Ciply and Maestricht, is perhaps a small example of *S. lineatus* (Sow.).

M. æquatoralis, Mayer-Eymar,[3] from Somaliland, is perhaps an allied form, but is imperfectly known at present.

Remarks.—The variations in this species consist chiefly in the amount of inflation and curvature of the valves, and in the flattening of the antero-ventral surface.

The examples from the Hythe Beds are usually larger, rather more inflated, and have the antero-ventral surface more flattened than those found in the Upper Greensand and Cenomanian. But all the different forms which the shell takes may be seen at all horizons, and from the examination of a large series of specimens I am convinced that the Lower Cretaceous forms cannot be separated from those of the Upper Cretaceous. The relative proportions of the valves of course change as age increases.

On account of the thinness of the shell the form of the valves has often become somewhat altered by pressure, and the shell itself—especially in specimens from the Hythe Beds—has often partly disappeared.

None of the specimens I have seen show the interior of the valves, but some of the internal casts give indications of the presence of an umbonal plate.

The name *M. Cottæ*, Römer, is adopted by Geinitz (1873) for this species, and *M. Cuvieri*, Mathéron, by Pictet and Campiche (1867), since the name *Mytilus lineatus* had been used by Gmelin in 1789 for another form, and *Modiola angusta* was also preoccupied by Deshayes (1824). D'Orbigny in 1850 substituted the name *sublineatus* for *lineatus*, Sow. If Sowerby's species be referred to *Septifer*, then his specific name may be retained.

[1] It should be noticed that Holzapfel's figures of this species are enlarged three times.

[2] "Mélanges Paléont.," pt. 1 ('Mém. cour. et Mém. des Sav. étrangers,' vol. xxiv, 1852), p. 152, pl. ix, figs. 12, 13.

[3] 'Vierteljahrs. nat. Gesellsch. Zürich,' vol. xxxviii (1893), p. 254, pl. i, figs. 7, 8.

Types.—I have not seen the types; they were obtained from the Hythe Beds, near Hythe. The type of *M. spathulatus*, Seeley, from the Barnwell Gravel (derived from the Chalk), is in the Woodwardian Museum, Cambridge.

Distribution.—Hythe Beds of Hythe and Lympne. Lower Greensand of Faringdon and Seend. Upper Greensand of Chilfrome (Dorset), and near Weymouth. Greensand of Haldon. Chloritic Marl of Maiden Bradley. Cenomanian (Meÿer's Bed 12) of Dunscombe and Kempstone Rocks (Sidmouth). Chalk Marl of Chardstock. Basement Bed of Chalk Marl of Cerne Abbas. Cenomanian Sands of Wilmington. Lower Chalk of Burwell and Stoke Ferry. Chalk Rock of Winchester, Cuckhamsley, Luton cutting, and Underwood Hall (Dullingham). Upper Chalk of Northfleet. Flint gravel (derived from Upper Chalk) near Ventnor. Zone of *Bel. quadrata* of Winchester and Salisbury. Zone of *Bel. mucronata* of Salisbury and Norwich.

Genus—Dreissensia, *P. van Beneden*, 1835.

('Ann. Sci. Nat.,' ser. 2, vol. iii, p. 193, pl. viii. Emend. *P. Fischer*, 'Man. de Conch.,' 1886, p. 972.)

Dreissensia lanceolata (*Sowerby*), 1823. Plate XVIII, figs. 13—15; Plate XIX, figs. 1—11.

1823.	Mytilus	edentulus, *J. de C. Sowerby.*	Min. Conch., vol. v, p. 55, pl. cccexxxix, fig. 1.
1823.	—	lanceolatus, *Sowerby.*	Ibid., fig. 2.
1836.	—	tridens, *J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 14.
1836.	—	prælongus, *Sowerby.*	Ibid., p. 342, pl. xvii, fig. 15.
1844.	—	lanceolatus, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 270, pl. cccxxxviii, figs. 5, 6.
1844.	—	falcatus, *d'Orbigny.*	Ibid., p. 280, pl. cccxli, figs. 11—13.
1845.	—	lanceolatus, var. edentulus, *E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 248.
? 1846.	—	— *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 15, pl. xxxvii, fig. 5.
1848.	—	— *H. G. Bronn.*	Index Palaeont., vol. i, p. 773.
1850.	Mitylus	abruptus, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 107.
1850.	—	subfalcatus, *d'Orbigny.*	Ibid., p. 166.
1850.	—	lanceolatus, *d'Orbigny.*	Ibid., p. 166.
1854.	Mytilus	edentulus, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 215.
1854.	—	lanceolatus, *Morris.*	Ibid., p. 215.
1854.	—	prælongus, *Morris.*	Ibid., p. 215.

1854. Mytilus tridens, *Morris*. Ibid., p. 215.
1858. — lanceolatus, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien de la Perte du Rhone (Matér. Pal. Suisse, ser. 1), p. 110, pl. xv, fig. 7.
? 1861. — Gallienei, *H. Trautschold*. Bull. Soc. Imp. Nat. de Moscou,
1867. — lanceolatus, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 485.
1868. — — *A. Briart and F. L. Cornet*. Descript. Meule de Bracquegnies (Mém. cour. et Mém. Sav. étrangers, vol. xxxiv), p. 52, pl. iv, figs. 11, 12. vol. xxxiv, pt. 2, p. 433, pl. xii, fig. 4.
? 1868. Modiola subfalcata, *E. Eichwald*. Lethæa Rossica, p. 533, pl. xxi, fig. 14.
1871. Mytilus lanceolatus, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 372.
1872. — — *F. Schmidt*. Mammuthexpéd. (Mém. de l'Acad. Imp. Sci. de St. Pétersb., vol. xviii, No. 1), p. 154, pl. ii, fig. 7; pl. iii, fig. 12.
? 1884. — — *J. F. Whiteaves*. Geol. and Nat. Hist. Survey of Canada: Mesozoic Fossils, vol. i, pt. 3, p. 236, pl. xxxi, fig. 7.

Non 1868. Modiola lanceolata, *E. Eichwald*. Lethæa Rossica, p. 532, pl. xxii, fig. 5.

Description.—Shell stout, convex; outline subtrapezoidal, or sometimes subtriangular. Hinge-margin slightly convex, sometimes straight, usually nearly half the length of the antero-ventral margin; the latter is slightly concave. Posterior margin convex, often roughly parallel to the antero-ventral margin, and curving gradually at the posterior extremity of the valve. Umbones sharp, terminal; apical angle varying from 47° to 53°—average 51½°. Carina sharp, but rather more rounded on the older parts of the shell; usually close to the margin except in the umbonal region. The shell in front of the carina is vertical, or nearly vertical, to the plane of the valves, except near the umbones, where it slopes outward. Behind the carina the shell slopes gradually to the posterior and dorsal margins. Ornamentation: the greater part of the shell is usually nearly smooth except for growth-lines, but concentric ribs are seen on the earlier parts and near the carina; sometimes also on the antero-ventral margin. Interior not seen except at the umbonal region; umbonal septum present; teeth absent or rudimentary.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
Antero-ventral margin	47	45	42	40	38	35	35	34	33	30	26	26	25	24	22	mm.
Hinge-margin . .	20	22	24	20	20	20	16	20	18	16	13	12	15	15	12	mm.
Diameter from the middle of the carina (perpendicular) to posterior margin .	16	19	19	18	18	17	14	17	15	13	12	11	13	—	10	mm.
Thickness . . .	17	21	18	15	16	19	15	16	15	13	12	12	11·5	10	11	mm.

1, 3, 4, 5, 7, 8, 10, 14 from the Crackers, Atherfield.
2 „ *Perna*-bed, Atherfield.
6, 9, 11, 12, 13, 15 from Blackdown.

Affinities.—The presence of an umbonal plate shows that this species should be referred to the Dreissensiidæ. In the few specimens showing the interior I have found no trace of the anterior myophore (for the byssal muscle) which distinguishes *Congeria* from *Dreissensia*[1]—but further specimens to confirm the absence of this structure are desirable. From the Upper Eocene of the Paris basin, associated with marine fossils, M. Cossmann[2] has already described two species of *Dreissensia*, and that author confirms my reference of this Cretaceous species to the Dreissensiidæ.

This species may be allied to *Mytilus tornacensis*, d'Archiac, from the Tourtia of Tournay, of which I have seen one specimen, sent me by M. Piret (see p. 91). That species, however, appears to differ from ours in having the carina at a greater distance from the antero-ventral border, also in the presence of more distinct and regular growth-lines with ridges or grooves at right angles to them, the ridges being best marked on the antero-ventral face of the shell. I do not know whether it possesses an umbonal plate or not. *M. subfalcatus*, d'Orbigny, from the Cenomanian, appears to have the concentric ribs more distinct on the carina than is usual in *M. lanceolatus*, but since this feature is seen in some specimens of the latter, and is generally present on the earlier parts of the shell, it can hardly be regarded as distinctive.

D'Orbigny considered that his *Mytilus Galliennei*,[3] which in outline is similar to the larger examples of *M. lanceolatus*, was identical with *M. tornacensis*, d'Arch.

The forms from the Aachen Greensand described by Müller as *M. tegulatus*, Müll., *M. lanceolatus*, Sow., and *M. falcatus*, d'Orb., whilst referred by Holzapfel[4]

[1] P. Oppenheim, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. li (1891), p. 923, pl. li.

[2] 'Cat. Ill. Coq. Foss. Eoc. de Paris,' fascic. 2 (1887), p. 151.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 273, pl. cccxxxix, figs. 1, 2; 'Prodr. de Pal.,' vol. ii (1850), p. 165.

[4] "Die Mollusk. Aachen. Kreide" ('Palæontographica,' vol. xxxv, 1889), p. 218, pl. xxv, figs. 1—9. It should be noted that these figures are enlarged twice.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1901.

LONDON:

MDCCCCI.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

PART III.

MODIOLOPSIDÆ AND SPONDYLIDÆ.

Pages 113—144; Plates XX—XXVI.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1901.

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C., AND 20, HANOVER SQUARE, W.

to *Septifer tegulatus*, are regarded by him as probably identical with Sowerby's species. I believe that view is probably correct, but without a larger series of specimens it is difficult to speak with confidence on the subject. The Aachen form is smaller and more variable in outline than the English species. I am indebted to Professor Holzapfel for the loan of several specimens.

M. subarcuatus, Meek and Hayden, from the Fox Hills group, is considered by Meek[1] to be near *M. lanceolatus*, but is only known from an internal cast.

Although it is possible for small fluviatile Lamellibranchs to be carried out to sea by currents and become entombed in marine deposits, such does not appear to have been the case with the species we are now considering, because (1) all the associated fossils are marine; (2) the lithological evidence is not in favour of the strata having been deposited near a shore-line; (3) the species occurs at several horizons and in more or less widely separated localities; and (4) some specimens have the two valves still united.

If, then, this species be truly marine, it might be urged that it is unlikely to belong to the genus *Dreissensia*, which at the present day is found in brackish and fresh waters only. That it does not belong to the genus *Septifer* is shown by the entire absence of radial sculpture, which characterises all the known species of that genus; in this feature, and also in the form of the shell, it agrees with living species of *Dreissensia*, differing only in the very young stages when (as shown by growth-lines on adult specimens) the shell was rather more elongate proportionately.

We have therefore apparently only two views to choose from concerning the generic position of the species here described as *Dreissensia lanceolata*:—(i) That it is an early marine form of *Dreissensia*; or (ii) that, although possessing the characters of *Dreissensia*, yet it has no direct genetic connection with that genus, but is an instance of heterogenetic homœomorphy. If the latter view be taken, then this species must be regarded as the type of a new genus. The former view seems more likely to be correct, unless it can be shown that the Tertiary *Dreissensiæ* have no connection with this species, but have descended from some other generic type.

That *Dreissensia* may have been marine at no very remote geological period seems possible from the fact that living forms occur in the brackish waters of the Aralo-Caspian area, etc.; that it probably was marine is supported by a study of its development,[2] which differs from that of other fresh-water Lamellibranchs, and agrees closely with that of certain marine forms. It is further noteworthy

[1] "Invert. Cret. and Tert. Foss. Missouri" ('U.S. Geol. Surv. Territ.,' vol. ix, 1876), p. 69, pl. xxxviii, fig. 2.

[2] A detailed account of the development of *Dreissensia polymorpha*, with a full bibliography, has been recently given by J. Meisenheimer, 'Zeitschr. für wissensch. Zool.,' vol. lxix (1901), pp. 1—137, pls. i—xiii.

that whilst a number of living genera of fresh-water mollusks occur in pre-Tertiary rocks, *Dreissensia* has not yet been found associated with them.[1]

Remarks.—Four examples from the Blackdown Greensand were described by Sowerby as distinct species under the names *edentulus*, *lanceolatus*, *tridens*, *prælongus*. Most later authors (d'Orbigny, Forbes, Bronn, Pictet and Renevier, Pictet and Campiche, Briart and Cornet, Stoliczka, Whiteaves, etc.) have considered these forms to be inseparable, and have united them under the name *lanceolatus*, but that view was not shared by Morris. An examination of all the available specimens leads me to agree with the opinion generally held.

In 1850 d'Orbigny regarded the Lower Cretaceous examples as distinct from those found in the Blackdown Greensand, and named them *Mytilus abruptus*. Pictet and Campiche did not uphold this separation. The only difference that I can detect is that, on the average, the examples found in the earlier beds reach a larger size than those in the later.

Types.—From the Blackdown Greensand: *M. edentulus* is in the British Museum; *M. tridens* and *M. prælongus* are in the Bristol Museum. I have not been able to trace the type of *M. lanceolatus*.

Distribution.—*Perna*-bed, Crackers, and Fitton's Beds 32 and 45, of Atherfield. *Perna*-bed of Sandown. Atherfield Beds of East Shalford and Peasmarsh. Ferruginous Sands of Shanklin. Sandgate Beds of Parham Park. Blackdown Greensand (zones x and xv). Greensand of Haldon. Upper Greensand of Shaftesbury.

Family—MODIOLOPSIDÆ, *Fischer*.

Genus—Myoconcha, *J. de C. Sowerby*, 1824.

(Min. Conch., vol. v, p. 103, pl. ccccl xvii.)

Myoconcha cretacea, *A. d'Orbigny*, 1844. Plate XX, figs. 3 *a*, *b*.

? 1832. Mytilus simplex, *A. Passy*. Géol. de la Seine-infér., p. 6 (expl. of plates), pl. xiii, figs. 4, 5. (Non *M. simplex*, Defrance, 1824.)

[1] W. J. Sollas, "On the Origin of Fresh-water Faunas," 'Scient. Trans. Roy. Dublin Soc.,' ser. 2, vol. iii (1884), p. 106; C. A. White, 'Third Ann. Rep. U.S. Geol. Survey' (1883), p. 423. It has been suggested that *Mytilus membranaceus*, Dunker, from the North German Wealden of Obernkirchen, Egestorf, Oesede, etc., and the Purbeck beds of Nienstedt and Linden, may belong to the Dreissensiidæ, but the characters of the interior of the shell are at present unknown; the same may be said of *Mytilus Lyelli*, Sowerby, from the English Purbeck and Wealden. See Dunker, 'Mon. Norddeutsch. Weald.' (1846), p. 25, pl. xi, f. 10, 11; C. Struckmann, 'Die Wealden-Bildungen von Hannover' (1880), p. 63, pl. i, f. 11, 12; P. Oppenheim, 'Zeitschr. der deutsch. geol. Gesellsch.,' vol. xliii (1891), p. 944.

1844.	Myoconcha cretacea,	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 260, pl. cccxxxv.
? 1847.	—	— *A. d'Archiac.*	Mém. Soc. géol. France, ser. 2, vol. ii, p. 307.
1850.	—	— *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 165.
1854.	—	— *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 214.
1862.	—	— *J. G. Chenu.*	Manuel de Conch., vol. ii, p. 155, fig. 766.
1866.	—	— *F. J. Pictet and G. Campiche.*	Moll. Foss. Terr Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), p. 344.
? 1868.	—	— *E. Eichwald.*	Lethæa Rossica, vol. ii, p. 588, pl. xxii, fig. 10.

Description.—Shell subtriangular, or more or less oblong, gradually increasing in height posteriorly. Anterior end blunt, rounded; posterior border rounded, somewhat oblique; ventral border nearly straight. Valves flattened, gradually compressed posteriorly, more sharply compressed towards the ventral margin.

Ornamentation consists of slender, equidistant, slightly curving, radial ribs, which are absent near the dorsal margin; the most dorsal rib is stronger than the others. The radial ribs are crossed regularly by numerous slender concentric ribs which are parallel to the growth-lines.

Measurements:

Length	74 mm.
Height	38 ,,
Thickness	28 ,,

Affinities.—*M. Requieniana*, Mathéron,[1] is less expanded posteriorly, and more concave ventrally.

Myoconcha, n. sp., Müller,[2] may be an allied form, but is known only by internal moulds.

Types.—From the Cenomanian of Saintes, Angoulême, Rouen, etc.

Distribution.—Basement bed of Chalk Marl (zone of *Schloenbachia varians*) of Chard, Maiden Newton, and Evershot. Chloritic Marl of Maiden Bradley, Woolcombe, and Toller Fratrum.[3]

[1] 'Cat. Foss. Bouches-du-Rhône' (1842), p. 177, pl. xxviii, figs. 3, 4. D'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 196.

[2] "Die Mollusk. d. Untersen. v. Braunschweig u. Ilsede" ('Abhandl. d. k. preuss. geol. Land.,' n. F., pt. 25, 1898), p. 48, pl. vii, fig. 3.

[3] Casts of *Myoconcha*, from the Lower Greensand of Seend, are preserved in the Museum of Practical Geology, but the species cannot, at present, be determined.

Family—SPONDYLIDÆ, *Gray*.

Genus—SPONDYLUS, *Linnæus*, 1758.

('Syst. Nat.,' ed. 10, p. 690.)

SPONDYLUS ROEMERI, *Deshayes*, 1842. Plate XX, figs. 4 *a*—*d*.

1841.	SPONDYLUS RADIATUS, *F. A. Römer* (non *Goldfuss*).	Die Verstein. d. norddeutsch. Kreidegeb., p. 60.
1842.	—	LATUS, *G. P. Deshayes* (non *Sowerby*), in *A. Leymerie*.	Mém. Soc. géol. de France, vol. v, pp. 10, 27, pl. vi, fig. 7.
—	—	ROEMERI, *Deshayes*.	Ibid., pp. 10, 27, pl. vi, figs. 8—10.
1847.	—	— *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 655, pl. cccli, figs. 1—6.
1850.	—	— *d'Orbigny*.	Prodr. de Pal., vol. ii, p. 83.
1855.	—	— *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 118.
1861.	—	— *P. de Loriol*.	Anim. Invert. Foss. du Mt. Salève, p. 107, pl. xiv, figs. 4, 5.
1870.	—	— *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 256, 260.
? 1871.	—	— *W. A. Ooster*.	Pteropodenschicht Schweizer-Alpen (Protozoe Helvetica, 2), pp. 126, 141, pl. xviii, figs. 8—10.
1883.	—	— *W. Keeping*.	Foss., etc., Neoc. Upware and Brickhill, p. 113.
1896.	—	— *A. Wollemann*.	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 834.
1900.	—	— *Wollemann*.	Die Biv. u. Gastrop. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preuss. geol. Land., n. F., pt. 31), p. 20.

Description.—Shell oval in outline, the proportion of length to height variable, more or less oblique. Right valve flattened, with numerous radial ribs, usually faintly marked, and strong concentric lamellæ. Left valve convex, with numerous slightly unequal ribs, separated by grooves of the same width; the larger ribs occur at regular intervals, and bear spines mostly directed ventrally: between the larger ribs are two or three smaller ribs, either smooth or with small spines. Ears of both valves apparently smooth.

Measurements :

Length	38 mm.
Height	40 „
Thickness	23 „

Affinities.—This species appears to be closely allied to *S. gibbosus*, d'Orbigny, but the ribs are more spiny and rather coarser, and the valves less convex in proportion to their size. It seems to differ from *S. striato-costatus*, d'Orbigny, in having more numerous and more slender ribs.

Remarks.—Deshayes' figures of this species appear to represent worn specimens, and consequently do not show the real characters of the ornamentation. In the absence of other specimens from the locality of the types one is obliged to rely on the figures and descriptions by d'Orbigny as giving the specific characters of *S. Roemeri*.

This species appears to be very rare in England. The examples from Brickhill are rather water-worn, but the stumps of the spines remain on some of the ribs.

Types.—From the Neocomian of Fouchères, in the École des Mines, Paris.

Distribution.—*Perna*-bed of Atherfield. Lower Greensand of Brickhill.[1]

SPONDYLUS GIBBOSUS, *d'Orbigny*, 1847. Plate XX, figs. 5, 6 *a*—*c*, 7 *a*—*c*, 8 *a*, *b*, 9 *a*, *b*, 10, 11.

1847.	SPONDYLUS	GIBBOSUS, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 658, pl. cccclii, figs. 1—6.
1850.	—	— *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 139.
1853.	—	BRUNNERI, *F. J. Pictet and W. Roux.*	Moll. Foss. Grès verts de Genève, p. 514, pl. xlvii, fig. 1 (? 2).
1858.	—	— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 136.
1866.	—	GIBBOSUS, *H. G. Seeley.*	Ann. Mag. Nat. Hist., ser. 3, vol. xvii, p. 177.
1870.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 257, pl. clxxxii, figs. 1—4.
1875.	—	— *A. J. Jukes-Browne.*	Quart. Journ. Geol. Soc., vol. xxxi, p. 297.
—	—	DUTEMPLEANUS? *Jukes-Browne.*	Ibid., p. 297.
—	—	— *J. Phillips.*	Geol. Yorks., ed. 3, pt. 1, p. 245.

[1] *Dianchora ? guttata*, Sharpe, from the Lower Greensand of Faringdon, is probably a *Spondylus*, but I have not succeeded in finding the type or any other specimens. Sharpe, 'Quart. Journ. Geol. Soc.,' vol. x (1853), p. 197, pl. vi, fig. 3.

Description.—Shell oval, oblique, higher than long. Right valve variable, flattened when attached by its entire surface, more convex when attached by a part only, the umbonal part sometimes much produced and talon-like. The attached part with concentric lamellæ, the free part with many radial ribs without spines.

Left valve moderately convex; umbo more or less produced; ribs numerous, unequal: the stronger occur at regular intervals, and are separated by two or three (rarely one only, or more than three) smaller ribs; the stronger ribs bear numerous spiny processes, the smaller ribs are usually without spines.[1]

Measurements of left valve:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	
Length .	31	31	30	29	26	25	25	21	19·5	23	21	19	16	mm.
Height .	36	35	34	36	31	28	27	25	23	25	23	22·5	19	„

(1—9) Cambridge Greensand.
(10—13) Red Limestone, Hunstanton.

Affinities.—For the relation of *S. gibbosus* to *S. Roemeri* see p. 117.

In *S. Dutempleanus* the shell is less oblique than in *S. gibbosus;* the spines on the left valve are generally more irregular and more nearly vertical than in the latter (judging from the figure of Pictet and Campiche). The stronger ribs which occur at regular intervals in *S. gibbosus* are never so distinctly marked in *S. Dutempleanus.*

Remarks.—The specimens figured by d'Orbigny, as pointed out by Pictet and Campiche, are worn examples with the shell imperfect. The specimens found in the Cambridge Greensand vary considerably; a gradual passage can be traced from forms in which the right valve is flat (fig. 9 *b*) to others in which it is much produced and talon-like (fig. 11); in the right valve the appearance of the surface depends largely on the amount of wearing the shell has undergone,—one specimen, in which the ribs appear almost equal and without spines, agrees perfectly with d'Orbigny's fig. 2; in most cases, however, the stronger ribs occurring at regular intervals are distinctly seen (fig. 6 *a*). Only the bases of the spines remain; they are generally regularly developed on the stronger ribs, but occasionally occur more irregularly (fig. 8 *a*).

The specimens found in the Red Limestone of Hunstanton and Speeton are, on the average, smaller than those in the Cambridge Greensand, and the spines, probably owing to the hardness of the matrix and consequent difficulty of extraction, are usually wanting or indistinct, but one specimen in the British Museum shows them clearly.

[1] The specimen figured by Pictet and Campiche shows spines on the small ribs. The general absence of small spines on our specimens is probably due to the worn nature of the shell.

Types.—D'Orbigny's specimens came from the Albian of Novion and Machéroménil (Ardennes).

Distribution.—Cambridge Greensand (derived from the Gault), Cambridge. Red Limestone of Hunstanton and Speeton.

SPONDYLUS STRIATUS (*Sowerby*), 1815. Plate XXI, figs. 1 *a*, *b*, 2, 3 *a*, *b*, 4, 5.

1815.	DIANCHORA STRIATA, *J. Sowerby.*	Min. Conch., vol. i, p. 183, pl. lxxx, fig. 1.
1819.	— — *Defrance.*	Dict. Scien. nat., vol. xiii, p. 161, pl. lxxviii, fig. 1.
1833.	SPONDYLUS STRIATUS, *A. Goldfuss.*	Petref. Germ., vol. ii, p. 98, pl. cvi, fig. 5.
1829–40.	DIANCHORA STRIATA, *F. E. Guérin-Méneville.*	Icon. du Règne Anim. Moll., p. 42, pl. xxv, fig. 4.
1837.	SPONDYLUS STRIATUS, *H. G. Bronn.*	Lethæa Geog., p. 687 (ed. 3, pt. 5, p. 283), pl. xxxii, fig. 4.
1840.	— — *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächsisch. Kreidegeb., pt. 2, p. 58.
1841.	— — *F. A. Römer.*	Die Verstein. d. nord-deutsch. Kreidegeb., p. 59.
? 1846.	— — *A. E. Reuss.*	Die Verstein. d. böhm. Kreideformat., pt. 2, p. 37, pl. xl, figs. 5, 10, 11.
1847.	— CAPILLATUS, *A. d'Archiac.*	Mém. Soc. géol. de France, ser. 2, vol. ii, p. 311, pl. xvii, fig. 1.
—	— STRIATUS, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 660, pl. ccccliii.
? 1850.	— — ?, *R. Kner.*	Kreidemerg. von Lemberg, etc. (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 30.
? —	— — ?, *A. Alth.*	Geogn.-pal. Beschreib. Umgeb. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 251.
—	— — *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 170.
—	— — *H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 194.
—	— CAPILLATUS, *Geinitz.*	Ibid., p. 194, pl. xi, figs. 2, 3.
? 1852.	— STRIATUS ?, *R. Kner.*	Denkschr. d. k. Akad. d. Wissensch. Wien. Math.-nat. Classe, vol. iii, pt. 1, p. 318, pl. xvii, fig. 8.
1854.	— — *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 182.
1858.	— — *J. A. Eudes-Deslongchamps.*	Mém. Soc. Linn. de Normand., vol. xi, p. 134, pl. xx, figs. 24—26.
? 1866.	— — *K. A. Zittel.*	Die Biv. der Gosaugeb. (Denkschr. d. k. Akad. d. Wissensch. Math.-nat. Classe, vol. xxv), p. 118 (p. 42 of reprint), pl. xviii, fig. 7 *b*, *c* (? fig. 7 *a*).

? 1868. Spondylus striatus, *E. Eichwald.* Lethæa Rossica, vol. ii, p. 422.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 261.
1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 186, pl. xlii, figs. 1–3.
? 1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreidef.: II, Die Weissenberg. u. Malnitz. Schicht., p. 138.
1878. — — *G. Behrens.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxx, p. 259.
1893. — — *R. Michael.* Ibid., vol. xlv, p. 237.
1895. — — *E. Tiessen.* Ibid., vol. xlvii, p. 475.
1897. — — *R. Leonhard.* Die Kreidef. in Oberschles. (Palæontographica, vol. xliv), p. 50.

Non 1822. Podopsis striata, *A. Brongniart.* Descript. géol. des Envir. de Paris. In *Cuvier*, Ossem. foss., ed. 2, vol. ii, pp. 319, 604, pl. v, fig. 3.
— 1870. Spondylus striatus, *F. Römer.* Geol. von. Oberschles., p. 315, pl. xxxvii, figs. 3, 4.

Description.—Shell large, obliquely ovate, high; anterior and ventral margins regularly rounded; posterior margin slightly concave or nearly straight.

Right valve usually more inflated than the left, and generally attached by the larger part of its surface; free part with radial ribs, separated by shallow grooves, and crossed by numerous very fine concentric lamellæ.

Left valve moderately convex, umbonal part prominent and produced; surface sometimes undulating; ribs numerous, equal, smooth, flattened, separated by deep grooves except on the later formed parts of the valve, where the grooves become shallow and the ribs less distinct. The grooves and ribs are crossed by concentric lamellæ, like those on the right valve. Ears smooth except for growth-lines.

Measurements of left valve:

	(1)	(2)	(3)	(4)	
Length	56	52	50	40	mm.
Height	77	65	58	48	,,

(1–4) from Warminster.

Affinities.—For the relation of this species to *S. latus*, Sowerby, see p. 123.

S. hystrix, d'Orbigny (? Goldfuss) is distinguished from this species by the left valve being less convex, the umbo less produced, the narrower and more widely separated ribs, and the spines on the earlier part of the valve.

S. capillatus, d'Archiac, from the Tourtia of Tournay, has been regarded by Geinitz, d'Orbigny, and other authors as a synonym of *S. striatus;* specimens

which I have obtained from Tournay agree perfectly with the English examples, but the example figured by d'Archiac appears to differ in having the umbo of the left valve less produced.

S. subcostulatus, Stoliczka,[1] appears to be a closely allied form, and was indeed regarded by Geinitz as identical with *S. striatus*.

S. complanatus, d'Orbigny, is imperfectly known, but may be closely allied to, or identical with, *S. striatus*; it is recorded by Morris from the Lower Greensand of Folkestone.

Remarks.—This species is known chiefly from specimens found at Warminster. An example from that locality in Mr. J. F. Walker's collection shows the interior of the right valve. The size of the attached surface varies considerably in different specimens.

Specimens showing the interiors of fixed valves, resembling *S. gibbosus* and *S. latus*, occur in the Blackdown Greensand and the Gault of Folkestone, but I am unable to determine the species without more specimens.

Type.—From Chute Farm, Warminster, in the British Museum.

Distribution.—Lower Greensand of Faringdon. Rye Hill Sand of Warminster. Upper Greensand, Longleat. Cenomanian Sandstone of Wilmington. Base of Chalk Marl of Maiden Newton. Cenomanian (Bed 11) of Branscombe.

SPONDYLUS LATUS (*Sowerby*), 1815. Plate XXII, figs. 1 *a*, *b*, 2 *a*, *b*, 3, 4 *a*, *b*, 5—7, 8 *a*—*c*, 9, 10 *a*, *b*.

1815.	DIANCHORA LATA, *J. Sowerby.*	Min. Conch., vol. i, p. 184, pl. lxxx, fig. 2.
1822.	— — *G. Mantell.*	Foss. S. Downs, p. 205, pl. xxvi, fig. 21.
—	— OBLIQUA, *Mantell.*	Ibid., p. 206, pls. xxv, fig. 1; xxvi, fig. 12.
1836.	SPONDYLUS LINEATUS, *A. Goldfuss.*	Petref. Germ., vol. ii, p. 97, pl. cvi, fig. 3.
1839.	— — *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 25. pl. xx, fig. 39.
1841.	— — *F. A. Römer.*	Die Verstein. des nord-deutsch. Kreidegeb., p. 59.
—	— LATUS, *Römer.*	Ibid., p. 59.
? —	— OBLIQUUS, *Römer.*	Ibid., p. 60.
1842.	— LATUS, *H. B. Geinitz.*	Char. d. Schicht. u. Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 82.

[1] "Palæontologia Indica," 'Cret. Fauna S. India,' vol. iii (1871), p. 449, pl. xxxiii, fig. 8; pl. xxxiv, fig. 2.

1842. Spondylus obliquus, *Geinitz.* Char. d. Schicht. u. Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 82.

1846. — (Dianchora) obliquus, *A. E. Reuss.* Die Verstein. d. böhm. Kreideformat., pt. 2, p. 36, pl. xl, fig. 4.

— — — lineatus, *Reuss.* Ibid., p. 36, pl. xl, figs. 7—9.

? 1847. — — — *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 34.

1850. — lineatus, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschl., p. 194 (*partim*).

— — obliquus, *Geinitz.* Ibid., p. 194 (*partim*).

— — lineatus, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 254.

— — latus, *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 356 (p. 386, ed. 2), pl. xxviii, figs. 30, 31.

? — — lineatus, *A. Alth.* Geogn.-pal. Beschreib. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 250.

1854. — latus, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 182.

? — — obliquus, *Morris.* Ibid., p. 182.

? 1868. — lineatus, *E. Eichwald.* Lethæa Rossica, vol. ii, p. 421.

? 1869. — — *E. Favre.* Moll. Foss. de la Craie des Envir. de Lemberg, p. 158.

1870. — striatus, *F. Römer.* Geol. von Oberschles., p. 315, pl. xxxvii, figs. 3, 4.

1872. — latus, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 187, pl. xlii, figs. 4—6; pt. 2, p. 32, pl. viii, figs. 18—21.

? 1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. II, Die Weissenberg. u. Malnitz. Schicht., p. 139.

1881. — æquicostatus, *R. Etheridge*, in *W. H. Penning and A. J. Jukes-Browne.* Geol. Cambridge (Mem. Geol. Survey), p. 145, pl ii, fig. 5.

1882. — latus, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 262.

? 1885. — cf. latus, *B. Lundgren.* Spondylus-art. i Sveriges Kritsyst. (Sver. Geol. Undersök., ser. C, No. 69), p. 12, pl. ii, fig. 28.

1889. — latus, *A. Fritsch.* Stud. im Gebiete der böhm. Kreidef. IV, Die Teplitz. Schicht., p. 86, fig. 82.

? — — cf. lineatus, *O. Griepenkerl.* Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 39.

— — latus, *E. Holzapfel.* Die Mollusk. d. Aachen. Kreide. (Palæontographica, vol. xxxv), p. 244, pl. xxvii, figs. 11, 14.

1892 — — *E. Stolley.* Die Kreide Schleswig-Holsteins (Mitth. a. d. Min. Institut der Univ. Kiel, vol. i), p. 236.

1897. — — *R. Leonhard.* Die Kreidef. in Oberschles. (Palæontographica, vol. xliv), p. 50.

— — — *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 387.

Non 1842. Spondylus latus, *A. Leymerie*. Mém. Soc. géol. de France, vol. v, p. 10, pl. vi, fig. 10.

Description.—Shell oval, rounded, more or less oblique, but sometimes nearly equilateral, of moderate size or small, height and length nearly equal. Right valve usually attached by its entire surface, and bearing concentric spiny lamellæ; when part of the valve is not attached it is ornamented with numerous radial ribs; the whole of the interior also shows numerous small radial ribs.

Left valve inflated, sometimes with undulating surface; growth-lines few and not strongly marked; the radial ribs are numerous, small, regular, flattened or rounded, without spines, and of equal size, except when new ribs are occasionally introduced; the ribs are separated by grooves of the same or less width, and in these are seen very faintly marked transverse ribs, which sometimes pass on to the radial ribs. Umbo small, pointed. Near the umbo some of the radial ribs, at regular intervals, are stronger than the others, and bear short spiny processes. Ears smooth.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Length . . .	25	25	24	23	21	26	34	40	43	23	mm.
Height . . .	26	25	24	23	20	27	36	37	39	23	„

(1—4) zone of *A. quadratus*, East Harnham, Salisbury.
(5) „ „ West Harnham, Salisbury.
(6, 7) zone of *M. cor-anguinum*, Gravesend.
(8, 9) zone of *H. subglobosus*, Cherry Hinton; (8) is the type of *S. æquicostatus*, Eth.
(10) Lower Chalk, Fulbourn Asylum.

Affinities.—The numerous smooth ribs serve to distinguish this species. *S. striatus*, Sowerby, from the Warminster Greensand, etc., is a much larger form, shorter in proportion to its height, and with the umbonal region more produced.

The form from the Lower Chalk, described by Etheridge as *S. æquicostatus*, cannot, I think, be separated from this species; the type (Pl. XXII, fig. 1) appears to differ somewhat from *S. latus*, but this is on account of its being an old individual; other smaller examples found on the same horizon are inseparable from *S. latus* found in higher zones of the Chalk. The Lower Chalk forms are in several cases somewhat larger than any that I have seen in the Middle or Upper Chalk. Two specimens from the Chalk Marl of Dover and Folkestone probably belong to this species, but more examples are needed before a definite determination can be made.

Types.—The type, from the Chalk of Lewes, and the specimen figured by Dixon, are in the British Museum. I have not seen the types of *Dianchora obliqua*, Mantell, which came from Lewes and Brighton; nor his figured specimen of *S. latus*. The type of *S. æquicostatus*, Etheridge, is in the Woodwardian Museum.

Distribution :

(i) *Lower Chalk:* Fulbourn Asylum. Zone of *H. subglobosus* of Shelford, Cherry Hinton, and cutting east of South Cave Station.

(ii) *Middle Chalk:* Lewes. Melbourn Rock near Hitchin. Zone of *R. Cuvieri* of Dover. Zone of *Terebratulina gracilis* of Dowlands (near Rousdon), the Dorset coast, Dover, the Sussex coast, Whyteleaf (Warlingham), St. Giles' Hill (Winchester), Hitchin, Worsted Lodge, and Mutlow Hill (Cambs). Zone of *Holaster planus* of Chapel Rock (Pinhay), Dover, the Sussex coast, Cheveley, and Linton. Chalk Rock (*Reussianum*-zone) of Brixton, Winchester, Cuckhamsley, Thickthorn Hill, and Boxmoor.

(iii) *Upper Chalk:* Zone of *M. cor-testudinarium* of Dover, the Sussex coast, and Balsham. Zone of *M. cor-anguinum* of Thanet, St. Margaret's, the Sussex coast, Charlton, Gravesend, Strood, Northfleet, and near Hitchin. Zone of *Marsupites* of Thanet and the Sussex coast. Zone of *A. quadratus* of Hensting Farm, Marwell Road, and Hensley Lane (all near Winchester), East and West Harnham (near Salisbury), and the Sussex coast. Zone of *B. mucronata* of the Dorset coast.

SPONDYLUS SERRATUS, sp. nov. Plate XXI, figs. 6 *a*—*c*, 7 *a*—*c*.

Description.—Shell rounded, outline rather irregular, slightly inequilateral; height and length nearly equal.

Right valve flattened or slightly concave, with numerous parallel, concentric, and spiny laminæ and faint radial ribs.

Left valve moderately convex, except in small forms; ornamented with numerous small ribs, which are of equal size except on the earlier parts of the shell, where new ribs are being introduced; all the ribs bear many small spines, placed regularly, but on the old parts of the shell the ribs may be nearly smooth. The grooves are broader than the ribs, moderately deep, and crossed by well-marked but somewhat irregular, transverse, thread-like ribs. Ears with four or five ribs.

Measurements :

	(1)	(2)	(3)
Length	20	23	32 mm.
Height	19·5	23	29 ,,

(1) Upper Chalk (*Uintacrinus*-bed), Devizes Road, Salisbury.
(2) Upper Chalk, locality unknown.
(3) Upper Chalk (*Uintacrinus*-bed), Newgate, Thanet.

Affinities.—This is similar in form to *S. latus*, but is distinguished by the small and regular spines, and the broader grooves between the ribs. *S. Royanus*,

d'Orbigny,[1] differs from this species in having stronger ribs at regular intervals, and in being proportionately higher.

S. asper, Goldfuss,[2] is similar in form, but the spines are coarser, fewer, and less regular.

S. occultus, Geinitz,[3] is a very small (7 mm.) form, which may be closely related to *S. serratus*, but the ribs appear to be more unequal and to bear tubercles which are in contact, instead of spiny processes distinctly separated from one another.

Remarks.—This is a very rare species; I have seen only five examples which could be definitely referred to it.

Distribution.—*Marsupites*-zone (*Uintacrinus*-bed) of Devizes Road, near Salisbury, and the Thanet coast.

SPONDYLUS DUTEMPLEANUS, *d'Orbigny*, 1847. Plate XXII, figs. 11 *a*, *b*, 12 *a*, *b*, 13, 14; Plate XXIII, figs. 1—5.

1833.	DIANCHORA SPINOSA, *S. Woodward.*		Geol. Norfolk, p. 48, pl. v, fig. 24.
1847.	SPONDYLUS DUTEMPLEANUS, *A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 672, pl. cccclx, figs. 6—11.
1850.	—	—	Prodr. de Pal., vol. ii, p. 254.
1869.	—	*E. Favre.*	Moll. Foss. de la Craie de Lemberg, p. 159, pl. xiii, figs. 14, 15.
1870.	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 262.
1887.	—	DUTEMPLEI, *A. Peron.*	Hist. du Terr. de Craie (Bull. Soc. Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii), p. 166.
1889.	—	DUTEMPLEANUS, *E. Holzapfel.*	Die Mollusk. d. Aachen. Kreide. (Palæontographica, vol. xxxv), p. 244, pl. xxvii, figs. 8—10.
1891.	—	*J. Böhm.*	Die Kreidebild. des Fürbergs, etc. (Palæontographica, vol. xxxviii), p. 88.
1892.	—	*E. Stolley.*	Die Kreide Schleswig-Holsteins (Mitth. a. d. Min. Inst. Kiel, vol. i), p. 236.
Non 1875.	—	?, *A. J. Jukes-Browne.*	Quart. Journ. Geol. Soc., vol. xxxi, p. 297.

Description.—Shell oval, slightly oblique, usually inflated, rounded ventrally, pointed and produced in the umbonal region. Right valve sometimes with greater,

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 671, pl. cccclx, figs 1—5.

[2] 'Petref. Germ.,' vol. ii (1836), p. 96, pl. cvi, fig. 1.

[3] "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx, pt. 1), p. 207, pl. xlvi, fig. 1. (N.B.—Enlarged about three times.)

sometimes less inflation than the left; the attached part bears concentric toothed lamellæ; the free surface has numerous regular, nearly equal radial ribs, separated by narrow grooves; in some cases the ribs carry short spines placed rather irregularly, and sometimes slender transverse ribs are seen.

Left valve usually regularly convex, with numerous slightly unequal ribs, which are occasionally a little wavy. The ribs are separated by grooves, generally of greater, but sometimes of the same width. The spines on the ribs are hollow, usually short, sometimes perpendicular to the surface, sometimes sloping ventrally; they may be developed rather irregularly, or larger spines may be borne on slightly stronger ribs at regular intervals; between these ribs are three or two slightly smaller ribs, with sometimes smaller spines. Faintly marked transverse ribs occur in the grooves, and sometimes extend on to the ribs. Ears smooth, except for growth-lines.

Measurements of left valve:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length .	20	22·5	23	23	26	17	22	27	24	mm.
Height .	23	25	25	26·5	30	19·5	26	30	27	„

(1—5) zone of *A. quadratus*, East Harnham.
(6—8) „ „ West Harnham.
(9) Chalk of Trimingham.

Affinities.—*S. Omalii*, d'Archiac,[1] appears to be a more oblique form with fewer ribs. The form referred by d'Orbigny[2] to *S. hystrix* is larger than *S. Dutempleanus*, and has the spines confined to the neighbourhood of the umbo. Specimens from the Cenomanian of Devon and Orbiquet (Normandy) agree with the Turonian and Senonian examples, except that the ribs are a little more widely separated. Similar Cenomanian forms from St. Fargeau (Yonne) and St. Sauveur (Yonne) have also been referred to *S. Dutempleanus* by d'Orbigny and by Peron.

S. fimbriatus, Goldfuss,[3] is very similar to *S. Dutempleanus;* judging from the figures alone, the only difference appears to be in the fewer spines on the ribs.

A specimen, described and figured by Sowerby[4] as *Lima? spinosa*, is perhaps an example of *S. Dutempleanus*. I have not been able to find the original, and the locality is not stated.

Remarks.—In the majority of specimens seen the spines have been more or less completely broken in the process of clearing away the matrix. Examples from

[1] 'Mém. Soc. géol. de France,' vol. ii (1847), p. 312, pl. xv, fig. 11.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), pl. ccccliv, figs. 1—9.

[3] 'Petref. Germ.,' vol. ii (1836), p. 97, pl. cvi, fig. 2. A specimen was referred to this species by Dixon ('Geol. Sussex,' p. 356, pl. xxviii, fig. 34).

[4] F. Dixon, 'Geol. Sussex' (1850), p. 347, pl. xxviii, fig. 33; p. 382 of ed. 2.

the Trimingham Chalk appear to have the spines placed more closely together than in other zones. The convexity of the valves varies considerably. The largest examples seen came from the *B. mucronata* zone of Norwich and Sheringham. A few imperfect specimens obtained from the Chalk Marl of Folkestone probably belong to this species.

Types.—From the Senonian of Epernay, St. Sauveur, and Auxon.

Distribution.—Cenomanian (Bed 11) of Maynard's Cliff, Sidmouth. Zone of *R. Cuvieri* of the Sussex coast. Zone of *Terebratulina gracilis* of St. Giles' Pit, near Winchester, and Dover. Zone of *H. planus* of Twyford Down, near Winchester, and Chapel Rock, Pinhay. Zone of *M. cor-testudinarium* of Dover. Zone of *M. cor-anguinum* of the Thanet coast, St. Margaret's, and the Sussex coast. *Uintacrinus*-band of Kingsgate (Margate). Zone of *Marsupites* of the Thanet and Sussex coasts. Zone of *Actinocamax quadratus* of Hursley (Winchester), East and West Harnham (Salisbury), and the Sussex coast. Zone of *B. mucronata* of Norwich, Sheringham, Clarendon (Salisbury), Ballard, and Studland. Chalk of Trimingham.

SPONDYLUS SPINOSUS (*Sowerby*), 1814. Plate XXIII, figs. 6—11; Plate XXIV, figs. 1—7.

1814. PLAGIOSTOMA SPINOSA, *J. Sowerby*. Min. Conch., vol. i, p. 177, pl. lxxviii, figs. 1—3.
? 1819. SPONDYLUS PODOPSIDEUS, *Lamarck*. Anim. sans Vert., vol. vi, p. 194.
? — PLAGIOSTOMA SULCATA, *Lamarck*. Ibid., p. 161.
1820. PECTINITES ACULEATUS, *E. T. v. Schlotheim*. Die Petrefactenkunde, p. 228.
1822. PLAGIOSTOMA SPINOSA, *G. Mantell*. Foss. S. Downs, p. 203, pl. xxvi, fig. 10.
— — BRIGHTONIENSIS, *G. Mantell*. Ibid., p. 204, pl. xxv, fig. 15.
— — SPINOSA, *A. Brongniart*. Descr. géol. des Envir. de Paris, pp. 251, 320, 600, pl. iv, fig. 2.
1825. PACHYTOS SPINOSUS, *Defrance*. Dict. Sciences nat., vol. xxxvii, p. 207, pl. lxxviii, fig. 2; pl. lxxix, fig. 1.
? — — STRIATUS, *Defrance*. Ibid., p. 207.
1827. PLAGIOSTOMA SPINOSUM, *S. Nilsson*. Petrif. Suecana, p. 25.
1833. — — *S. Woodward*. Geol. Norfolk, p. 40, pl. v, fig. 25 (? young).
1836. SPONDYLUS SPINOSUS, *A. Goldfuss*. Petref. Germ., vol. ii, p. 95, pl. cv, fig. 5.
— — DUPLICATUS, *A. Goldfuss*. Ibid., vol. ii, p. 95, pl. cv, fig. 6.
1837. PLAGIOSTOMA SPINOSUM, *W. Hisinger*. Lethæa Suecica, p. 54, pl. xv, fig. 4.
— SPONDYLUS SPINOSUS, *H. G. Bronn*. Lethæa Geog., p. 684 (ed. 2), p. 280 (vol. ii, pt. 5, ed. 3), pl. xxxii, fig. 6.

1839. SPONDYLUS SPINOSUS, *H. B. Geinitz.* Char. d. Schicht. u. Petref. das sächs. Kreidegeb., pt. 1, p. 24.

— — DUPLICATUS, *Geinitz.* Ibid., p. 25.

1841. — SPINOSUS, *F. A. Römer.* Die Verstein. des norddeutsch. Kreidegeb., p. 58.

— — DUPLICATUS, *Römer.* Ibid., p. 58.

1842. LIMA BRIGHTONIENSIS, *F. v. Hagenow.* Rügen'schen Kreideverstein. Neues Jahrb. für Min., etc., 1842, p. 556.

1846. SPONDYLUS SPINOSUS, *H. B. Geinitz.* Grundr. der Verstein., p. 474.

— — (PACHYTOS) SPINOSUS, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 36.

1847. — SPINOSUS, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 673, pl. cccclxi, figs. 1—4.

1848. — — *H. G. Bronn.* Index Palæont., vol. i, p. 1189.

1850. — — *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 196.

— — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 254.

? — — — *A. Alth.* Geog.-pal. Beschreib. der Umgeb. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 250.

1852. — — *R. Kner.* Denkschr. d. k. Akad. d. Wissensch. Math.-nat. Cl., vol. iii, p. 318.

1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 182.

— — BRIGHTONIENSIS, *Morris.* Ibid., p. 182.

1855. — SPINOSUS, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 118.

1859. — ÆQUALIS, *E. Hébert.* Bull. Soc. géol. de France, ser. 2, vol. xvi, p. 149.

1860. — SUBSPINOSUS, *H. Coquand.* Descript. Départ. de la Charente, vol. ii, p. 142. (Non d'Archiac, 1848.)

1868. — SPINOSUS, *E. Eichwald.* Lethæa Rossica, vol. ii, p. 420.

? 1869. — — *E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 158.

1870. — — *F. Römer.* Geol. von Oberschles., p. 315, pl. xxxiv, fig. 11.

1871. — SUPERBUS, *H. Willett.* Cat. Cret. Foss. Brighton Mus., p. 35.

1872. — SPINOSUS, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. ii), p. 31, pl. ix, figs. 1—3.

1876. — — *D. Brauns.* Die Senon. des Salzberges (Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi), p. 391.

1877. — — var. DUPLICATUS, *A. Fritsch.* Stud. im Geb. der böhm. Kreidef. II. Die Weissenberg. u. Malnitz. Schicht, p. 138, fig. 132.

1881. LIMA SPINOSA, *R. Etheridge.* In Penning and Jukes-Browne's Geol. Cambridge (Mem. Geol. Survey), pp. 65, 69, 72.

1882. SPONDYLUS ÆQUALIS, *B. Lundgren.* Bull. Soc. géol. de France, ser. 3, vol. x, p. 458.

1885.	Spondylus	æqualis, *Lundgren.*		Spondylusart. i Sverig. Kritsyst. (Sverig Geol. Undersök., ser. C, No. 69), p. 5, pl. i, figs. 1—3.
1889.	—	—	*O. Griepenkerl.*	Senon von Königslutter (Palæont. Abhandl., vol. iv), p. 38.
—	—	spinosus,	*E. Holzapfel.*	Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 243, pl. xxvii, figs. 12, 13.
—	—	—	*A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitzer Schicht, p. 85, fig. 81.
1897.	—	—	*H. Woods.*	Quart. Journ. Geol. Soc., vol. liii, p. 385.
—	—	—	*R. Leonhard.*	Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 50.
—	—	æqualis,	*A. Hennig.*	Revis. Lamell. i Nilsson's 'Petrif. Suecana' (Kön. Fysiogr. Sällsk. i Lund. Handl., N. F., vol. viii), p. 25.
1898.	—	spinosus,	*G. Müller.*	Mollusk. Untersen. von Braunschweig u. Ilsede (Abhandl. d. k. preuss. geol. Land., n. F., pt. 25), p. 23, pl. iv, fig. 4.

Description.—Shell regular, ovate, slightly inequilateral, rounded ventrally, more or less pointed and produced in the umbonal region, where the margins are only slightly curved. Valves sometimes equally convex, but the right usually flattened; convexity greatest in the median line, towards the umbo.

Right valve a little larger than the left, with the dorsal part of the posterior border longer than the corresponding part of the anterior border. Ribs stronger than those of the left valve, separated by deep narrow grooves; the grooves are crossed by rather irregular linear ridges. In some specimens almost every rib is divided into two parts by a narrow median furrow—the furrows starting, in different specimens, at varying distances from the umbo; in others only a few ribs (often near the centre of the valve or near the anterior and posterior borders) are so divided; or all the ribs may be undivided. Long slightly curving spines, with a groove on their upper surfaces, are borne at intervals by some of the ribs—frequently by eight, and grow out radially, those near the margin of the valve extending outwards in all directions roughly parallel to the plane of the valves; the spines near the anterior and posterior margins are the strongest. The ribs bearing spines are often not divided by a groove.

Left valve with from 26 to 51 regular, rounded ribs, occasionally bearing short spines; the grooves between the ribs may be wider or narrower than the ribs, and are crossed by many rather irregular linear ridges, which sometimes extend on to the ribs. The ribs may be (1) all of uniform size, separated by broader grooves, and are then relatively few in number and stout; or (2) the stronger ribs may alternate regularly with smaller ribs introduced in the grooves at varying distances

from the umbo, thus increasing the total number of ribs at the margin of the valve; or (3) only a few smaller ribs occur here and there between the larger. The first is associated with undivided ribs on the right valve; the second with all the ribs divided; the third with a few ribs divided—the divided ribs of the right valve corresponding in position with the small intercalated rib of the left valve. Rarely one or two ribs on the left valve may be divided. In old specimens rather strong growth-lines placed near together occur near the margin of the valve, giving it a frilled appearance. Near the umbones the ribs sometimes have a serrated appearance, due to the presence of short, close-set, spiny processes. Ears on both valves with growth-lines only or with faintly marked radial ribs also near the umbones; at the inner border the ear is limited by a ridge (often indistinct on the left valve), and between this and the commencement of the regular series of radial ribs on the valve is a smooth area.

Measurements of the left valve.

	Zone of *T. gracilis.*							Zone of *H. planus.*											
Length (in millimetres) . .	49	48	47	47	35	34	...	57	53	49	47	46	45	44	42	42	41	40	38	33	30
Height „ „ . .	53	50	51	49	38	39	...	59	59	57	52	49	48	46	48	49	44	43	39	34	31
Number of main ribs . .	33	43	27	30	33	27	...	34	33	33	29	33	28	31	34	28	30	33	30	31	32
Number of small intermediate ribs	9	8	8	11	5	8	...	14	10	9	22	36	14	18	9	10	8	6	0	6	1

	Chalk Rock.			Zone of *M. cor-testudinarium.*							Zone of *M. cor-anguinum.*						
Length	51	46	37	...	52	41	41	38	35	34	...	72	62	55	51	51	50	47
Height	62	50	41	...	55	47	45	43	38	36	...	83	69	57	56	55	60	53
Number of main ribs . .	30	33	26	...	30	26	25	25	25	28	...	30	35	34	26	31	27	29
Number of small intermediate ribs	11	11	8	...	10	14	14	10	12	2	...	4	17	15	0	8	14	7

	Zone of *Marsupites testudinarius.*														
Length	53	53	53	47	47	47	45	44	43	43	43	42	40	37	35
Height	60	59	56	50	47	52	51	49	54	49	46	47	44	40	41
Number of main ribs . .	30	29	31	29	29	37	28	28	29	28	26	26	27	27	35
Number of small intermediate ribs	4	6	19	0	0	12	0	0	0	0	1	1	0	3	13

	Zone of *A. quadratus.*						Zone of *B. mucronata.*			Trimingham Chalk.		
Length	55	40	33	29	27	26	...	52	...	36	31	
Height	65	42	36	31	30	28	...	56	...	40	32	
Number of main ribs . .	35	28	27	27	31	29	...	32	...	30	27	
Number of small intermediate ribs	13	16	0	4	2	11	...	0	...	4	0	

Remarks.—The amount of convexity of the two valves together, and also the relative convexities of right and left valves, varies considerably in different examples, and is to some extent associated with differences in the ribbing. On the right valve the variation in the ribs consists (1) in the presence or absence of a narrow furrow on the rib—giving the appearance of a split rib,—and (2) in the period at which this furrow is introduced. Coincident with the beginning of

the furrow on this valve is the introduction of a small intermediate rib between two main ribs on the left valve, so placed that at the margin of the valve the small furrow of the right valve fits into the small rib of the left valve. The number of the small intermediate ribs and the period at which they are introduced vary considerably in different specimens; in some cases they are quite absent, in others only a few occur, or they may appear in almost every groove. When these intermediate ribs are absent, the other ribs appear to be stronger and are equal in size, and separated by broad and deep grooves; the form named *S. æqualis* by Hébert belongs, I believe, to this group. Another form, with many intermediate ribs, was named *S. duplicatus* by Goldfuss; this, however, has been regarded by most later writers (Geinitz, Reuss, d'Orbigny, Brauns, etc.) as inseparable from *S. spinosus*. In the cases where the intermediate ribs are introduced at an early period, they become towards the margin of the shell almost or quite as large as the other ribs, so that the shell appears to bear a large number of rather small ribs, and differs greatly in appearance from the forms with no intermediate ribs. Between these different varieties every transition seems to occur, but certain types, as noted below, are more abundant in some zones than in others.

The form described by Hébert as *S. æqualis*[1] was found in the *B. mucronata* Chalk of Meudon. It was stated to differ from *S. spinosus*, Sowerby, in having (1) equal ribs (*i. e.* no intermediate ribs) on the left valve, and undivided ribs on the right valve; (2) the two valves of equal convexity; (3) spines on both valves. Hébert gave no figures, but Lundgren has figured specimens from Kopinge, which, however, do not show the spines. I believe that *S. æqualis* is only one of the varieties of *S. spinosus*. Forms found in the Upper Chalk of England (especially in the *B. mucronata* and *Marsupites* zones) agree in the first and second of the features above mentioned, and also in rare cases show spines on the left valve, although never so well developed as those on the right. This form, as already stated, passes into the one with many intermediate small ribs. It will, however, probably be convenient to refer to the two extremes as the *æqualis*-type and the *duplicatus*-type respectively.

Plagiostoma brightoniensis, Mantell, seems to be an old individual belonging to the *æqualis*-type; it occurs chiefly in the *M. cor-anguinum* zone. Near the margin of the left valve intermediate ribs are introduced, and at this part on both valves growth-lines are well marked and close together, giving something of a frilled appearance.

S. obesus, d'Orbigny,[2] from the Senonian, appears to be only a variety of

[1] It is recorded by Barrois from the *B. mucronata* zone of Studland Bay and Norwich. See 'Rech. Terr. Crét. Supér.' (1876), pp. 103, 163.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 675, pl. cccclxi, figs. 5—7.

S. spinosus, having the valves rather more convex than usual and the ribs on the ears a little more distinct.

Two small specimens in Dr. Blackmore's collection from the *A. quadratus* zone of East Harnham (length 6 mm.), and the *B. mucronata* zone of Clarendon (length 6·5 mm.), are probably young individuals of *S. spinosus*.

S. superbus, Willett, MS., is an example of the *æqualis*-type from the Upper Chalk (probably *Marsupites* zone) of Seaford.

The inner layer of the shell, and also the area and teeth, have been removed by solution from the specimens of *S. spinosus* and other species of *Spondylus* found in the Chalk of England.[1]

A large number of good specimens of *S. spinosus* are preserved in most museums and collections, but unfortunately, in the majority of cases, the zones from which they were obtained are not definitely known, and consequently, in order to determine whether any of the varieties are characteristic of particular zones, I have had to rely mainly on the collections kindly lent me by Drs. Blackmore and Rowe, and Messrs. Jukes-Browne, W. Hill, G. E. Dibley, and J. Scanes, and on my own collecting. Similarly, in selecting specimens for figuring, I have chosen those of which the exact horizon is known even when finer examples of the same type, but of uncertain zone, were at hand. In order to work out satisfactorily the zonal characters of *S. spinosus*, a much larger number of carefully collected specimens than I have had at my disposal would be required, and the following notes on the forms found in successive zones must, therefore, be regarded as of a preliminary nature only.

T. gracilis-zone.—The common forms (Pl. XXIII, fig. 6) have the valves flattened. Ribs on the left valve are generally slender and separated by broad grooves; intermediate (small) ribs are seen in all cases, and, as a rule, are moderately numerous. Forms with the left valve more convex occur rather rarely (Pl. XXIII, fig. 7).

H. planus-zone and Chalk Rock.—Valves, especially the left, are more convex than in the preceding zone; ribs rather stouter (Pl. XXIII, figs. 8—10). Some forms having few or no intermediate ribs occur (Pl. XXIII, fig. 8).

M. cor-testudinarium-zone.—Commonly the left valve is very convex, and the intermediate ribs are introduced early and become nearly as large as the others (Pl. XXIII, fig. 11). Less common are forms with only a few intermediate ribs.

M. cor-anguinum-zone.—Convexity of the two valves is generally more nearly equal. Intermediate ribs are generally small and not numerous, and the main ribs stout (Pl. XXIV, figs. 1, 2). The old individuals of this type, named *Plagiostoma*

[1] For a more detailed account of this, with references to previous writers on the subject, see Woods, 'Quart. Journ. Geol. Soc.,' vol. liii (1897), p. 386.

brightoniensis by Mantell, occur chiefly in this zone, but occasionally in the previous zone (Pl. XXIV, fig. 3).

Marsupites-zone.—Two types occur : (i) with few or no intermediate ribs and the valves of nearly equal convexity (Pl. XXIV, figs. 4, 6); (ii) with many intermediate ribs of nearly the same size as the main ribs, and valves of nearly equal convexity : this is not so common as the first type (Pl. XXIV, fig. 5).

A. quadratus-zone.—The same two types occur. Only a few examples have been seen, the average size being apparently less (Pl. XXIV, fig. 7).

B. mucronata-zone.—No intermediate ribs in the examples seen (similar to Pl. XXIV, fig. 4).

Trimingham Chalk.—Two rather small examples are in Mr. A. C. Savin's collection, one without intermediate ribs, and the other having four. Another specimen is in Mr. R. M. Brydone's collection.

Types.—Sowerby's types from Brighton and Northfleet are in the British Museum. I have not seen the specimen figured by Mantell as *Plagiostoma spinosa*, nor the type of *P. brightoniensis*. *S. superbus*, Willett, MS., is in the Brighton Museum. The types of *S. duplicatus*, Goldfuss, came from the Senonian of Quedlinburg and Coesfeld.

Distribution.—*S. spinosus* ranges from the zone of *Rhynchonella Cuvieri* to zone of *B. mucronata*. A few of the localities are given below.

i. Zone of *R. Cuvieri.*—Dover.

ii. Zone of *Terebratulina gracilis.*—Dowlands (near Rousdon). Whitecliff (Seaton). Hooken (near Beer Head). St. Giles's Hill and Twyford Down (Winchester). East Knoyle (Wilts). The Sussex coast. Dover. Whyteleaf (Warlingham). Dunton Green. Preston (Hitchin). Luton.

iii. Zone of *Holaster planus.*—Chapel Rock (Pinhay). St. Giles's Hill (Winchester). The Sussex coast. Dover. Cuxton. Borstal. Cheveley (Newmarket). Three quarters of a mile north-west of West Wratting (Cambs).

iv. Chalk Rock.—West Wycombe. Princes Risborough. Cuckhamsley. Boxmoor. Luton. Clothall (Herts). Quickwood (Herts). Reed and Newsells (Royston). Underwood Hall (Dullingham). Barkway. Great Chesterford.

v. Zone of *Micraster cor-testudinarium.*—West of Beer Harbour. North of Alton Line Junction. The Sussex coast. Dover. Chatham. Purley. Balsham.

vi. Zone of *Micraster cor-anguinum.*—Hungry Down, Blandford. Mitcheldever (upper part of zone). Eaton Lane and Winnal Road (Winchester). The Sussex coast. St. Margaret's. Thanet. Gravesend.

vii. Zone of *Marsupites testudinarius.*—Witherington, near Salisbury (lower part of zone). Devizes Road, near Salisbury (*Uintacrinus*-band). The Sussex and Thanet coasts. Margate.

viii. Zone of *Actinocamax quadratus.*—The Dorset coast. East and West

Harnham (Salisbury). Hursley. Hensting Farm (Winchester). The Sussex coast.

ix. Zone of *Belemnitella mucronata*.—Studland Bay. ? Winchester. Norwich. Sheringham.

x. Trimingham Chalk.

Genus—Plicatula, *Lamarck*, 1801.

('Syst. Anim. sans Vert.,' p. 132.)

Plicatula placunea, *Lamarck*, 1819. Plate XXV, figs. 1—4.

1819.	Plicatula placunea, *Lamarck*.		Anim. sans Vert., vol. vi, p. 186.
1822.	Spondylus ? strigilis, *A. Brongniart*.		Descript. géol. Envir. de Paris. In *Cuvier*, Ossem. foss., ed. 2, vol. ii, pp. 333, 613, pl. ix, fig. 6.
1826.	Plicatula placunata, *Defrance*.		Dict. Sciences nat., vol. xli, p. 400.
1842.	—	placunæa, *A. Leymerie*.	Mém. Soc. géol. de France, vol. v, pp. 16, 27, pl. xiii, fig. 2.
—	—	— *P. Mathéron*.	Catal. Foss. des Bouches-du-Rhône, p. 189.
1845.	—	— *E. Forbes*.	Quart. Journ. Geol. Soc., vol. i, p. 249.
1847.	—	placunea, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 682, pl. cccclxii, figs. 11—18.
1850.	—	— *d'Orbigny*.	Prodr. de Pal., vol. ii, pp. 84, 119.
—	—	— *Ewald*.	Zeitschr. d. deutsch. geol. Gesellsch., vol. ii, p. 470.
1853.	—	— *F. J. Pictet and W. Roux*.	Moll. Foss. Grès verts de Genève, p. 518, pl. xlvii, fig. 5.
1854.	—	— *J. Morris*.	Cat. Brit. Foss., ed. 2, p. 180.
1855.	—	placunæa, *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 118.
1858.	—	placunea, *F. J. Pictet and E. Renevier*.	Foss. Aptien de la Perte du Rhône, etc. (Matér. Pal. Suisse, ser. 2), p. 136.
—	—	— *J. A. Eudes-Deslongchamps*.	Les Plicat. du Calvados (Mém. Soc. Linn. Norm., vol. xi), p. 102, pl. xvii, figs. 1, 2.
1859.	—	— *J. Vilanova-y-Piera*.	Mém. géog.-agric. de Castellon, pl. ii, fig. 16.
1865.	—	— *H. Coquand*.	Aptien de l'Espagne, p. 158.
1866.	—	— *E. Eichwald*.	Zeitschr. d. deutsch. geol. Gesellsch., vol. xviii, p. 271.
1868.	—	— —	Lethæa Rossica, vol. ii, p. 414.
1871.	—	— *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 268, 271.

1875. Plicatula placunea, *J. Phillips.* Geol. Yorks., ed. 3, pt. 1, p. 244.
1900. — — *A. Wollemann.* Die Biv. u. Gastrop. des deutsch. u. holländ. Kreide. (Abhandl. d. k. preuss. geol. Land., n. F., pt. 31), p. 23.

Description.—Shell very oblique, oval, projecting and pointed at the umbones; length greater than height. Left valve flat or slightly concave; right valve convex. Both valves ornamented with strong angular ribs, usually eight to ten in number, bearing tubular overlapping spines; between these large ribs smaller ones are introduced, and bear spiny processes. Near the margin of the shell, in old individuals, the two sets of ribs may become of nearly equal size. The ribs are crossed by concentric, usually faintly marked lamellæ, and at intervals by well-marked growth-lines.

Measurements:

	(1)	(2)	(3)	(4)
Length . .	36	27	25	19 mm.
Height [1] .	33	24	24·5	20 „

(1—4) from Hythe.

Affinities.—This is distinguished from *P. inflata*, Sowerby, and *P. Carteroniana*, d'Orbigny, by greater development of spines and the presence of the smaller ribs.

Distribution.—Hythe Beds of Hythe, Lympne, St. Martha's (East Shalford), Sevenoaks, and Maidstone. ? Ferruginous Sands of Shanklin. ? Speeton Clay. Recorded by Fitton (1847) from the *Perna*-bed of Atherfield.[2]

Plicatula Carteroniana, *d'Orbigny*, 1847. Plate XXV, figs. 5 *a*, *b*, 6 *a*, *b*, 7—12.

1847. Plicatula Carteroniana, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 680, pl. cccexlii, figs. 5—7.
1850. — — *d'Orbigny.* Prodr. de Pal., vol. ii, p. 83.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 180.
1871. — Carteroni, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 265, 271, pl. clxxxiii, figs. 3, 4.
1883. — — *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 110, pl. v, fig. 4.
1896. — Carteroniana, *A. Wollemann.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 835.

[1] Measured obliquely from the umbo to the middle of the ventral margin.

[2] I have not been able to find the type or other specimens of *Plicatula inæquidens*, Sharpe, from the Lower Greensand of Faringdon, 'Quart. Journ. Geol. Soc.,' vol. x (1853), p. 197, pl. vi, fig. 4.

1900. Plicatula Carteroniana, *Wollemann*. Die Biv. u. Gastr. d. deutsch. u. holländ. Neoc. (Abhandl. d. k. preuss. geol. Land., n. F., pt. 31), p. 22.

Description.—Shell oval, somewhat triangular, oblique; height greater than length. Right valve much inflated, ornamented with usually eight to ten sharp, prominent ribs, which are slightly curved, bear short spiny processes, and are separated by broad furrows; well-marked growth-lines occur at intervals. Left valve flat or slightly concave; ribs less prominent, more rounded, and broader than on the right valve, separated by narrow furrows.

Measurements:

	(1)	(2)	(3)	
Length	17	13	11	mm.
Height[1]	21	16	14	,,

(1—3) from Upware.

Types.—From the Neocomian of Maisons, near the Écorces (Doubs). The specimen figured by Keeping is in the Woodwardian Museum.

Distribution.—Hythe Beds of Hythe and (Bargate Stone) of St. Catherine's Hill (Guildford). Sandgate Beds of Sevenoaks. Lower Greensand of Brickhill, Potton, and Upware.

Plicatula æquicostata, *Keeping*, 1883.

1883. Plicatula æquicostata, *W. Keeping*. Foss., etc., Upware and Brickhill, p. 111, pl. v, fig. 5.

Description.—Shell small, ovate, oblique, high, very inequivalve, margins rounded. Right valve much inflated, umbonal part prominent, with a small area for attachment; ornamented with numerous (about fifty) small, regular, rounded ribs, which curve slightly, are of nearly equal size, and are separated by narrow grooves; these ribs are crossed by small concentric lamellæ, and occasionally by stronger growth-lines. Left valve flat or slightly concave, with similar ornamentation, but the ribs apparently fewer and broader.

Measurements:

	(1)	(2)	
Length	9	16	mm.
Height	14	19·5	,,
Thickness	8·5	11	,,

(1, 2) from Upware. (1) the type.

[1] Measured obliquely.

Affinities.—This species appears to be closely allied to *P. imbricata*, Koch and Dunker,[1] from the Hilsthon of the Elligser Brink, but is distinguished by the left valve being flat or concave. The shell is also very similar in form to *P. Carteroniana*, and may even prove to be only a worn example of that species.

Remarks.—The only undoubted specimens which I have seen are the three rather imperfectly preserved examples on which the species was founded.

Types.—In the Woodwardian Museum.

Distribution.—Lower Greensand of Upware.

Plicatula gurgitis, *Pictet and Roux*, 1853. Plate XXV, figs. 13 *a*, *b*, 14—21.

1823.	Plicatula	pectinoides, *J. de C. Sowerby* (non *Lamarck*).	Min. Conch., vol. v, p. 5, pl. cccclx, fig. 1.
1847.	—	radiola, *A. d'Orbigny*.	Pal. Franç. Terr. Crét., vol. iii, p. 683 (*partim*), pl. cccclxiii, figs. 6, 7 (*non* 1—5).
1850.	—	— —	Prod. de Pal., vol. ii, p. 139 (*partim*).
1853.	—	gurgitis, *F. J. Pictet and W. Roux*.	Moll. Foss. Grès verts de Genève, p. 517, pl. xlvii, fig. 4.
1854.	—	pectinoides, *J. Morris*.	Cat. Brit. Foss., ed. 2, p. 180.
? 1855.	—	radiola, *G. Cotteau*.	Moll. Foss. de l'Yonne, p. 118.
1871.	—	gurgitis, *F. J. Pictet and G. Campiche*.	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 272.
1875.	—	pectinoides, *A. J. Jukes-Browne*.	Quart. Journ. Geol. Soc., vol. xxxi, p. 297.

Non 1846.	Plicatula	pectinoides, *A. E. Reuss*.	Die Verstein. d. böhm. Kreidef., pt. ii, p. 37, pl. xxxi, figs. 16, 17 (= *P. Barroisi*, Peron).
—	—	— — *J. de C. Sowerby*.	Trans. Geol. Soc., ser. 2, vol. v, p. 328, pl. xxii, figs. 6, 9 (= *P. peregrina*, d'Orbigny).

Description.—Shell oval, more or less triangular, umbonal part generally produced; margins rounded, the postero-dorsal being often concave. Inequivalve: right valve sometimes only slightly, but generally very convex, somewhat flattened near the umbones; left valve concave, sometimes flat. Right valve ornamented with numerous narrow, sharp, radial ribs, curving and slightly irregular, separated by broad spaces. The ribs bear many spines, having usually a roughly concentric arrangement, and being longest near the margins of the valves. Concentric

[1] 'Norddeutsch. Oolithgeb.' (1837), p. 50, pl. vi, fig. 3; G. Böhm, 'Zeitschr. der deutsch. geol. Gesellsch.,' vol. xxix (1877), p. 236; A. Wollemann, "Die Biv. u. Gastrop. des deutsch. u. holländ. Neoc." ('Abhandl. d. k. preussisch geol. Landesanst.,' n. F., part 31, 1900), p. 23.

lamellæ and well-marked growth-lines are present. The ribs vary in number considerably in different specimens, but are always more numerous near the ventral margin than near the umbo, owing to the intercalation of new ribs. Left valve ornamented with similar but usually broader and more rounded ribs, crossed by numerous concentric lamellæ.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
Length . .	53	48	47	39	36	33	31	30	25	22	22	17	mm.
Height[1] . .	48	44	46	51	40	38	28	36	28	30	29	20	,,
Number of ribs at margin of right valve .	39	34	25	29	23	19	19	24	24	26	28	11	

(1—7, 11, 12) from the Gault of Folkestone; (8—10) from the Gault near Cambridge.

Affinities.—See *P. inflata* (p. 140).

Remarks.—This species was described by Sowerby as *Plicatula pectinoides* (Lamarck). The type of Lamarck's species came from the Lias of Metz,[2] and is quite distinct from the Cretaceous species; the latter must, therefore, be known as *P. gurgitis*, Pictet and Roux.

Types.—The types of *P. pectinoides*, Sowerby, from the Gault near Cambridge, appear to have been lost.

Distribution.—Gault of Folkestone (zones i—iii, vi, viii, x, xi), of Ford (near Aylesbury), and of Barnwell (Cambridge). Cambridge Greensand (derived from the Gault). Red Limestone of Hunstanton. Upper Greensand of the Isle of Wight.

PLICATULA MINUTA, *Seeley*, 1866. Plate XXV, figs. 22—25.

1866. PLICATULA MINUTA, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. xvii, p. 176.

Remarks.—The ornamentation of this small form is of the same type as that of *P. gurgitis*, but the ribs are perhaps more numerous than at the umbo of that species. Comparison, however, is difficult, since the umbo of *P. gurgitis* is seldom well preserved. It seems probable that *P. minuta* is only the young form of *P. gurgitis*, but since the smallest known example of the latter is very much larger

[1] Measured obliquely from the umbo to the middle of the ventral margin.

[2] *Placuna pectinoides*, Lamarck, 'Anim. sans Vert.,' vol. vi (1819), p. 224. *Plicatula pectinoides*, Defrance, 'Dict. Sciences nat.,' vol. xli (1826), p. 400; Deshayes and Milne Edwards, Lamarck's 'Anim. sans Vert.,' ed. 2, vol. vii (1836), p. 178; d'Orbigny, 'Prodr. de Pal.,' vol. i (1849), p. 238.

than the largest of the former, it is at present impossible to trace a passage from one to the other.

Types.—From the Red Limestone of Hunstanton, in the Woodwardian Museum.

Distribution.—Cambridge Greensand. Red Limestone of Hunstanton and Speeton.

PLICATULA INFLATA, *Sowerby*, 1823. Plate XXVI, figs. 1—11.

1819.	PLICATULA	RADIOLA, *Lamarck.*	Anim. sans. Vert., vol. vi, p. 185 (? *partim*).
1822.	—	SPINOSA, *G. Mantell.*	Foss. S. Downs, p. 129, pl. xxvi, figs. 13, 16, 17 (non *spinosa*, Sowerby).
1823.	—	INFLATA, *J. de C. Sowerby.*	Min. Conch., vol. v, p. 6, pl. cccclx, fig. 2.
1836.	—	— *A. Goldfuss.*	Petref. Germ., vol. ii, p. 102, pl. cvii, fig. 6.
—	—	RADIOLA, *Lamarck.*	Anim. sans Vert., ed. 2 (by Deshayes and Milne Edwards), vol. vii, p. 177 (? *partim*).
? 1846.	—	INFLATA, *A. E. Reuss.*	Die Verstein. der böhm. Kreideformat., pt. 2, p. 37.
1847.	—	RADIOLA, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 683 (*partim*), pl. cccclxiii, figs. 1—5 (*non* 6, 7).
—	—	SPINOSA, *d'Orbigny.*	Ibid., p. 685, pl. cccclxiii, figs. 8—10.
1850.	—	RADIOLA, *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 120.
1852.	—	— *R. Kner.*	Denkschr. d. k. Akad. d. Wissensch. Math.-nat. Cl., vol. iii, p. 319, pl. xvii, fig. 9.
1853.	—	— *F. J. Pictet and W. Roux.*	Moll. Foss. Grès verts de Genève, p. 516, pl. xlvii, fig. 3.
1854.	—	INFLATA, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 180.
1855.	—	RADIOLA, *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 118.
1858.	—	— ?, *J. A. Eudes-Deslongchamps.*	Mém. Soc. Linn. de Normand., vol. xi, p. 103, pl. xvii, figs. 3—8.
? —	—	INFLATA ?, *Eudes-Deslongchamps.*	Ibid., p. 100, pl. xvi, figs. 31—33.
—	—	— *F. J. Pictet and E. Renevier.*	Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 137.
1859.	—	— *A. v. Strombeck.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xi, p. 37.
1863.	—	— —	Ibid., vol. xv, p. 109.
1865.	—	— *H. Coquand.*	Mon. Aptien de l'Espagne, p. 159.
1871.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 269.
1882.	—	— *R. Windmöller.*	Jahrb. d. k. geol. preussisch Geol. Landesanst.' (1881), p. 21.

1882.	Plicatula spinosa, *J. Kiesow.*	Schrift der Nat. Gesellsch. in Danzig, n. F., vol. v, p. 241.
1885.	— inflata, *F. Nötling.*	Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 15, pl. ii, fig. 3.
1887.	— — *A. Peron.*	Hist. du Terr. de Craie (Bull. Soc. Sci. Hist. et Nat. de l'Yonne, ser. 3, vol. xii), p. 169, pl. ii, fig. 3.
1889.	— — *A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitz. Schicht, p. 86, fig. 84.
1895.	— — *E. Tiessen.*	Zeitschr. der deutsch. geol. Gesellsch., vol. xlvii, p. 477.
? 1897.	— — *A. Fritsch.*	Stud. im Gebiete der böhm. Kreideformat. VI. Die Chlomeker Schicht, p. 68, fig. 88.

Description.—Shell oval or somewhat triangular—more distinctly oval in large specimens; very oblique, margins rounded. Right valve moderately convex, the convexity increasing considerably with age, so that in old specimens the later part of the valve curves considerably from the less convex earlier part. Left valve flat or concave. Right valve ornamented with regular, radial, slightly curved ribs, which are usually few in number, and bear short recumbent spines, which are longer at the anterior and posterior margins; a few new ribs may be introduced between the older ones. Left valve with similar ribs and spines.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Length .	18	22	23	24	25	27	28	37	45	45	49	mm.
Height[1] .	22	23	21	26	28	27	30	38	41	47	50	„

(2) from the Lower Chalk, Ventnor.
(8) from the Chalk Marl, Haslingfield.
(9) from the *H. subglobosus* zone, Cherry Hinton.
Others from the Totternhoe Stone, Burwell.

Affinities.—From a comparison of specimens of *P. radiola*, d'Orbigny, from the Aptian, with specimens of *P. inflata*, Sowerby, from the English Cenomanian, Pictet, Renevier, and Campiche came to the conclusion that the two forms could not be regarded as distinct species. My own observations lead me to endorse the opinion of those writers—that examples of the same size are inseparable. In the Cenomanian, however, the specimens often reach a larger size than any I have seen from the Lower Cretaceous; in such cases the ventral part of the valve is nearly smooth, or has only indistinct ribs. Figures of a large and also a small form from the Chalk are given by Goldfuss, and good figures of an Aptian specimen by Pictet and Roux. Peron has named some very small forms from the Cenomanian *P. Cotteaui*, and considers that *P. spinosa*, d'Orbigny, is an example

[1] Measured obliquely from the umbo to the middle of the ventral margin.

of the same. He admits, however, that *P. Cotteaui* is practically inseparable from *P. radiola*, d'Orbigny, and gives the name chiefly because it occurs on a different horizon. Peron considers that *P. Cotteaui* is distinct from *P. inflata*: after the examination of a large series of specimens of different ages I am unable to accept that view, especially in consideration of the large amount of variation which occurs in the very closely allied species *P. gurgitis*. *P. inflata* is distinguished from *P. gurgitis* by the fewer and more regular ribs and the fewer spines; also by the ribs being absent or indistinct on the ventral part of the valves in large specimens. Some specimens of *P. inflata*, with more numerous ribs, approximate to certain examples of *P. gurgitis* which have fewer ribs than usual; this is more particularly seen in some examples from the Upper Greensand.

Remarks.—The number and strength of the ribs vary in different examples; large specimens are sometimes almost smooth (*e. g.* Pl. XXVI, fig. 9).

Since two forms were included by Lamarck under the name *P. radiola*, and since uncertainty exists as to which of them his name should be applied to, I follow Pictet, Renevier, and Campiche in retaining the name *inflata* given by Sowerby.

Types.—*P. inflata* is from the Cenomanian near Cambridge; the specimens cannot now be found. The type of *P. spinosa*, Mantell, is in the British Museum.

Distribution.—Upper Greensand near Nursted and (Chert Series) of the Isle of Wight. Rye Hill Sand of Warminster. Chloritic Marl of Maiden Bradley and the Isle of Wight. Grey Chalk of Folkestone. Chalk Marl of Ventnor, Folkestone, Reach, Burwell, Haslingfield, Harlton, Speeton, etc. Zone of *Holaster subglobosus* of Hitchin, Totternhoe, Arlsey, Isleham, Burwell, Cherry Hinton, Fulbourn, Shelford, Louth, Withcall, Speeton, etc.

I have seen no examples from the English Lower Cretaceous which could be definitely referred to this species, but Topley (1875) has recorded *P. inflata* from the Hythe and the Sandgate Beds.

Plicatula Barroisi, *Peron*, 1887. Plate XXVI, figs. 12—18.

1846. Plicatula pectinoides, *A. E. Reuss* (non *Sowerby*). Die Verstein. der böhm. Kreideformat., pt. ii, p. 37, pl. xxxi, figs. 16, 17.

1850. — nodosa, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 254 (*partim*).

1872. — — *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. ii, p. 32, pl. ix, fig. 5.

1878. — — *C. Barrois*. Terr. Crét. des Ardennes (Ann. Soc. géol. Nord, vol. v), p. 391.

1887. Plicatula Barroisi, *A. Peron.* Hist. du Terr. de Craie (Bull. Soc. Sci. Hist. Nat. de l'Yonne, ser. 3, vol. xii), p. 167, pl. ii, figs. 5—7.

1889. — nodosa, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. IV. Die Teplitz. Schicht, p. 86, fig. 83.

1895. — *cf.* nodosa, *B. Lundgren.* Mollusk. i *Mammill.*-och *Mucron*-zonerna i nordöstra Skåne (K. Svenska Vet.-Akad. Handl., n. s., vol. xxvi, No. 6), p. 41.

1897. — Barroisi, *H. Woods.* Quart. Journ. Geol. Soc., vol. liii, p. 388, pl. xxvii, figs. 18, 19.

Description.—Shell small, ovate, rounded, a little oblique. Right valve inflated, with the apical part truncated by the attached surface, which is often fairly large. Left valve flattened or slightly concave, often with a subcircular opening near the umbo. Both valves ornamented with more or less numerous, strong, nearly smooth and rounded ribs, separated by deep and well-marked grooves; the ribs may bifurcate near the margins of the valves, and new ribs may be intercalated. Strongly marked growth-lines occur at intervals, and also concentric lamellæ, the latter being most distinct on the left valve.

Measurements:

	(1)	(2)	(3)	(4)	
Length	5·75	5·5	5·0	4·5	mm.
Height	6·0	6·0	5·75	5·5	„

(1—4) from the Chalk Rock, near Winchester.

Remarks.—This species was described and figured by Reuss as *P. pectinoides*, Sowerby, but it differs greatly from Sowerby's species. D'Orbigny referred it to *P. nodosa*, Dujardin;[1] Geinitz and Fritsch followed the same course. Barrois, although using the name *P. nodosa*, stated that Dujardin's figure was very incomplete, and consequently his specimens could not be identified as belonging definitely to that species. Peron subsequently pointed out that the species under consideration differs considerably from *P. nodosa*, Dujardin; the latter being about four times larger, more elevated, and ornamented with large, simple, widely separated ribs. He therefore described and figured it as a new species—*P. Barroisi.*

Types.—Reuss's specimens came from the Pläner-Kalk and Pyrope Sand of Irziblitz, and from the Pläner-Mergel of Weberschan. Peron's figured specimens came from the Upper Turonian of Valmy.

Distribution.—Zone of *R. Cuvieri* of the Devon coast. Zone of *T. gracilis* of the Devon coast and Dover. Zone of *H. planus* of Dover, the Sussex coast, Twyford (Winchester), etc. Chalk Rock of Winchester, etc. Zone of *M. cor-*

[1] 'Mém. Soc. géol. de France,' vol. ii (1837), p. 228, pl. xv, fig. 14.

testudinarium of Dover and the Sussex coast. Zone of *M. cor-anguinum* of the Thanet coast, the North Foreland, St. Margaret's, and the Sussex coast. *Uintacrinus* band of Kingsgate. *Marsupites* zone of the Sussex and Thanet coasts. Zone of *B. mucronata* of Clarendon, near Salisbury.

PLICATULA SIGILLINA, *Woodward*, 1864. Plate XXVI, figs. 19—22.

? 1852. SPONDYLUS DICHOTOMUS, *A. Buvignier*. Statist. géol., etc., de la Meuse, Atlas, p. 25, pl. xix, figs. 16, 17.

1864. PLICATULA SIGILLINA, *S. P. Woodward*. Geol. Mag., vol. i, p. 112, pl. v, figs. 1—5.

Description.—Shell small, semi-oval or semicircular in outline, a little oblique. Hinge margin long. Right valve attached by nearly the whole of its surface; interior with slightly raised radial ribs, somewhat irregular, becoming more numerous at the sharp raised margin; beyond this margin is a broad smooth sloping border bounded by a raised edge, outside which are, in some cases, radial ribs. Left valve slightly convex, ornamented with well-marked concentric lamellæ.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Length .	14	15	15	6·5	11	16	9	17	18	21	mm.
Height[1] .	12	15	17	6	10	12	9	16	16	18	,,

(1—3) *M. cor-testudinarium* zone, Chatham.
(4—6) *M. cor-anguinum* zone, Gravesend.
(7—10) *B. mucronata* zone, Hartford Bridge, Norwich.

Affinities.—The form from the Gault of Clermont and Les Islettes (Argonne, Meuse), described by Buvignier as *Spondylus dichotomus*, is probably identical with this species; it is especially like examples of *P. sigillina* from the Cambridge Greensand and the Gault of Folkestone.

P. sigillina differs from the other Cretaceous *Plicatulæ* here described in being attached by almost the entire surface of the right valve, and in the absence of radial ribs or folds on the left valve; in these respects it resembles the completely fixed forms of the recent species *P. philippinarum*, Hanley.

Remarks.—This species occurs attached to *Echinocorys*, *Inoceramus*, *Belemnitella*, and other fossils. The fixed valve is common in the Norwich Chalk and the Cambridge Greensand. The left valve is much less frequently found than the right, and at present appears to be known only from the Upper Chalk and the *H. planus* zone. The inner layer of the shell has undoubtedly disappeared, and

[1] Measured obliquely.

consequently the character of the hinge and the adductor impression cannot be seen. A small oyster, as noted by Dr. S. P. Woodward, is often found in the Chalk attached to echinoids, etc., and is similar in general appearance to *Plicatula sigillina;* but it is easily distinguished by its triangular ligament-pit and clearly marked adductor impression, by the absence of ribs from the interior of the attached valve, and by the more porous structure of the shell.

Types.—One of the types (Woodward's fig. 1) from Grays is in the British Museum. The others, from the Upper Chalk of Norwich and Grays, I have not seen.

Distribution.—Upper Gault (zones x and xi) of Folkestone. Cambridge Greensand. Grey Chalk of Dover. Zones of *R. Cuvieri*, *T. gracilis*, and *H. planus* of Dover and the Sussex coast. Zone of *M. cor-testudinarium* of Chatham, Dover, and the Sussex coast. Zone of *M. cor-anguinum* of Gravesend, the Thanet coast, Kingsgate Castle, St. Margaret's, and the Sussex coast. Zone of *Marsupites* of the Thanet and Sussex coasts. *Uintacrinus*-band of Devizes Road (near Salisbury). Zone of *A. quadratus* of the Dorset and Sussex coasts. Zone of *B. mucronata* of the Dorset coast, Hartford Bridge, etc. (near Norwich).

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1902.

LONDON:

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

PART IV.

PECTINIDÆ.

PAGES 145—196; PLATES XXVII—XXXVIII.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1902.

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C.; 20, HANOVER SQUARE, W.; AND DORKING.

Family—PECTINIDÆ,[1] *Lamarck.*

Genus—PECTEN, *Müller*, 1776.

('Prodr. Zool. Dan.,' p. 248.)

Sub-genus—SYNCYCLONEMA, *F. B. Meek*, 1864.

('Check List of Invert. Foss. N. America, Cret. and Jur.,' Smithson, Misc. Coll. 177, pp. 7, 31.)

Syncyclonema should probably be united with *Entolium*, as has been suggested by Philippi, since in the former the concentric ornamentation of the right valve is sometimes incompletely developed, and the ears have, in some cases, a more or less well-marked dorsal prolongation; on the other hand, in some forms of *Entolium* the dorsal prolongation of the ears is insignificant. *Syncyclonema* is the earlier of the two names. The type of *Entolium*[2] is *Pecten demissus*, Phillips; this has also been taken by Verrill[3] as the type of *Protamusium*.

PECTEN (SYNCYCLONEMA) ORBICULARIS, *Sowerby*, 1817. Plate XXVII; and Text-fig. 1.

1817.	PECTEN ORBICULARIS,	*J. Sowerby.*	Min. Conch., vol. ii, p. 193, pl. clxxxvi.
1819.	—	— *Lamarck.*	Anim. sans Vert., vol. vi, pt. 1, p. 182.
1822.	—	LAMINOSUS, *G. Mantell.*	Foss. S. Downs, p. 128, pl. xxvi, figs. 8, 22.
1825.	—	ORBICULARIS, *Defrance.*	Dict. Sci. nat., vol. xxxviii, p. 252.

[1] Recent accounts of the classification of the Pectinidæ have been given by—A. E. Verrill, "A Study of the Pectinidæ, with a Revision of the Genera and Sub-genera," 'Trans. Connecticut Acad.,' vol. x (1897), p. 41. F. Sacco, "Molluschi dei Terreni Terziarii del Piemonte e della Liguria;" pt. 24, "Pectinidæ," 1897. W. H. Dall, "Tertiary Fauna of Florida," 'Trans. Wagner Free Inst. of Philadelphia,' vol. iii, pt. 4 (1898), pp. 689—758. E. Philippi, "Beiträge zur Morphologie und Phylogenie der Lamellibranchier:" (1) "*Hinnites* und *Velopecten*," 'Zeitschr. der deutsch. geol. Gesellsch.,' vol. l (1898), p. 597; (2) "Zur Stammesgeschichte der Pectiniden," ibid., vol. lii (1900), p. 64. A. Locard, "Faune Malacologique Française," xi, "Monographie des Espèces appartenant au Genre *Pecten*," 'Ann. Soc. Linn. de Lyon,' vol xxxiv (1888), p 133. C. Depéret and F. Roman, "Monographie des Pectinidés néogènes de l'Europe et des régions voisines," 'Mém. Soc. géol. de France (Paléont.),' vol. x, pt. 1 (1902).

[2] Meek, "Geol. Survey of California," 'Geology,' vol. i, Appendix B (1865), pp. 478, 479.

[3] 'Trans. Connect. Acad.,' vol. x (1897), p. 71.

? 1836. PECTEN LAMINOSUS, *A. Goldfuss.* Petref. Germ., vol. ii, p. 76, pl. xcix, fig. 9.
— ORBICULARIS, *Lamarck.* Anim. sans Vert. (ed. 2, by Deshayes and Milne-Edwards), vol. vii, p. 159.
1839. LAMINOSUS, *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 23.
— — CIRCULARIS, *Geinitz.* Ibid., p. 23.
1841. — ORBICULARIS, *F. A. Römer.* Die Verstein. nord-deutsch. Kreidegeb., p. 49.
— — LAMINOSUS, *Römer.* Ibid., p. 49.
1843. — ORBICULARIS, *H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 16.
1844. — — *A. d'Orbigny.* In X. Hommaire de Hell, Les Steppes de la Mer Caspienne, vol. iii, p. 439, pl. vi, figs. 18—20.
? 1845. — — *E. Forbes.* Quart. Journ. Geol. Soc., vol. i, p. 249.
1846. — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 27, pl. xli, figs. 18, 19.
— — LAMINOSUS, *Reuss.* Ibid., p. 27, pl. xxxix, fig. 5.
1847. — ORBICULARIS, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 597, pl. cccexxxiii, figs. 14—16.
? — — LAMINOSUS, *J. Müller.* Petref. Aachen. Kreideformat., pt. 1, p. 31.
1848. ORBICULARIS, *H. G. Bronn.* Index Palæont., vol. i, p. 928.
1850. — *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 180.
— — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 169.
? 1852. — — *R. Kner.* Denkschr. d. k. Akad. d. Wissensch. Math.-nat. Classe, vol. iii, p. 315.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 177.
1855. — *G. Cotteau.* Moll. Foss. de l'Yonne, p. 116.
1863. — *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 108.
1868. — — *E. Eichwald.* Lethæa Rossica, vol. ii, p. 423, pl. xx, fig. 4.
1869. — SUBLAMINOSUS, *E. Favre.* Moll. Foss. Craie de Lemberg, p. 143, pl. xiii, fig. 1.
1870. — ORBICULARIS, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 206.
— — — *W. A. Ooster.* Protoz. Helvet., vol. ii, p. 57.
1871. — (SYNCYCLONEMA) ORBICULARIS, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.
1872. — LAMINOSUS, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 192, pl. xliii, fig. 14.
1873. — OPERCULARIS, *W. Dames.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxv, p. 68; ibid, vol. xxvi, p. 763 (foot-note).
1874. (AMUSIUM) ORBICULARIS, *Dames.* Ibid., vol. xxvi, p. 763.

1871. Pecten laminosus, *Dames.* Ibid., p. 764.
1876. *H. Deicke.* Die Tourtia von Mülheim a. d. Ruhr, p. 26.
1877. *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Die Weissenberg. und Malnitz. Schicht., p. 136, fig. 126.
— orbicularis, *G. Boehm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 233.
1881. — *J. Kiesow.* Schrift. d. nat. Gesellsch. in Danzig, N. F., vol. v, p. 415.
1882. — cf. orbicularis, *R. Windmöller.* Jahrb. d. k. preussisch. geol. Landesanst. für 1881, p. 20.
1883. — orbicularis, var. magnus, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 106, pl. v, fig. 1.
1885. — (Syncyclonema) orbicularis, *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont Abhandl., vol. ii), p. 19, pl iii, figs. 4, 5.
— — laminosus, *Nötling.* Ibid., p. 19, pl. iii, fig. 3.
? Syncyclonema sublaminosa, *J. Böhm.* Verhandl. des nat. Vereins d. preussisch. Rheinl., vol. xlii, p. 83.
? 1889. Pecten laminosus, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 231.
1893. — orbicularis, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 236.
— laminosus, *Michael.* Ibid., p. 235.
? 1894. — orbicularis, *A. Hennig.* Geol. Fören. i Stockholm Förhandl., vol. xvi, p. 519.
1895. — Cottaldinus, *G. Maas.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 269.
1896. — orbicularis, var. Lohmanni, *A. Wollemann.* Ibid., vol. xlviii, p. 839, pl. xxi, fig. 1.
1897. *U. Söhle.* Geognost. Jahreshefte, N. J. (1896), p. 40, pl. iv, fig. 8.
Syncyclonema orbicularis, *R. B. Newton.* Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, p. 84, pl. iii, fig. 9.
1900. Pecten germanicus, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 41, pl. viii, figs. 13—19.

Non 1827. Pecten orbicularis, *S. Nilsson.* Petrif. Suecana, p. 23, pl. x, fig. 12 (= *P. Nilssoni*, Goldf.).
— 1846. — ?, *E. Forbes.* Trans. Geol. Soc., ser. 2, vol. vii, p. 154 (= *Amusium sulcatellum*, Stol.).

Description.—Shell ovate or nearly orbicular, nearly equilateral; height a little greater than length; margins on each side of the umbo straightened, that on the posterior side being slightly longer than the corresponding anterior part. Valves

flattened, compressed near the straight margins; the left valve sometimes rather more convex than the right. Ears rather small, nearly equal, the anterior slightly larger than the posterior, both often slightly produced dorsally; external margins usually curving, sometimes nearly straight; those of the posterior ears somewhat more oblique than those of the anterior. Surface of ears smooth or with growth-lines, and occasionally radial striæ. Umbones sharp; apical angle varying from 99° to 115°, average 106°. No byssal sinus. Hinge similar to *Amusium*.

Right valve ornamented with broad and usually well-marked concentric ridges and furrows, varying in number. Ridges flat, and, in well-preserved specimens, with a ventral laminar portion projecting over the next furrow; the furrows are narrower or absent near the antero- and postero-dorsal margins. The ridges are ornamented with fine concentric grooves, and with finer radial striæ, the latter being seen best near the antero- and postero-dorsal margins.

Left valve appears almost or quite smooth to the naked eye, but with a lens is seen to be ornamented with numerous fine concentric grooves, and sometimes with fine radial striæ.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	
Length	25·5	24	22	15·5	13·5	21·5	31	47	40	39·5	55	30	26	24	15·5	44	73	22	13	69	34	31	23·5	mm
Height	27·5	26	25	17	15·5	25	34	50	43	42	56	33	28	26	17	47	76	23	14	70	36	33·5	26	„

(1—4) Tealby Limestone.
(5) Folkestone Beds, Folkestone.
(6, 7) Greensand (Chert Beds), Haldon.
(8—11) Upper Greensand, Ventnor.
(12, 13) „ „ Warminster.
(14—16) Gault, Folkestone.
(17—19) Chalk Marl, Folkestone.
(20, 21) Chalk Marl, Burwell.
(22, 23) Totternhoe Stone, Burwell.

Affinities.—*P. germanicus*, Wollemann, from the Neocomian of Brunswick, appears to be inseparable from this species. The characters regarded as distinctive by Dr. Wollemann, such as the fine concentric striæ on the left valve, the more laminar character of the concentric ribs on the right, and their radial striæ, are also found in many specimens of *P. orbicularis*; their presence and distinctness depend mainly on the state of preservation of the specimens. Dr. Wollemann has examined a specimen from the Tealby Limestone (similar to Pl. XXVII, figs. 1, 2), and informs me that it is undoubtedly identical with his *P. germanicus*; he has also kindly sent me specimens of the latter from near Brunswick, and they seem to be quite inseparable from *P. orbicularis*. The difference in horizon is mentioned by Dr. Wollemann as giving some support to his view that the Neocomian form is distinct, but since *P. orbicularis* ranges, without a break, from the zone of *B. brunsvicensis* to the zone of *Holaster subglobosus*, we must rather regard the continuous distribution as favourable to the identity of the earlier and later forms.

P. orbicularis, var. *magnus*, Keeping, from Upware, is a large variety of this species, and is similar to a form found in the Chalk Marl (Text-fig. 1). In the

specimens which I have seen, the concentric ornament on the right valve is indistinct, owing to the imperfect preservation of the surface of the shell, but in several cases the fine concentric grooves are clearly shown on the left valve.

Pecten Darius, d'Orbigny,[1] from the Albian, is a closely allied form, but at present is known only by the brief description in the 'Prodrome.' The form from the Gault of Cosne, described by De Loriol[2] as *P. Darius*, appears to differ from *P. orbicularis* in the inequality of its ears; the figures do not show the character of the ornamentation satisfactorily. *Amusium sulcatellum*, Stoliczka,[3] and *P. concentrice-sulcatus*, Müller,[4] appear to be closely allied to *P. orbicularis*.

The Senonian specimens described by Goldfuss, Holzapfel, etc., as *P. laminosus*, Goldfuss, and by Favre and Böhm as *P. sublaminosus*, seem to agree with those forms of *P. orbicularis* which have more numerous ribs than usual, and particularly with some examples from the Warminster Greensand and the Chloritic Marl of Maiden Bradley. Professor Holzapfel has kindly sent me eight specimens from the Aachen Greensand, but it is difficult to compare them satisfactorily with English examples owing to their different mode of preservation. There does not, however, appear to be sufficient reason to regard them as distinct from the Cenomanian forms of *P. orbicularis*. The ears in the example figured by Goldfuss are larger than is usual in *P. orbicularis*.

P. membranaceus, Nilsson,[5] is similar in form to *P. orbicularis*, but has the concentric ornamentation very fine, so that the shell appears to be almost smooth. *P. Nilssoni*, Goldfuss,[6] is also distinguished by being nearly smooth, and (judging from Goldfuss' fig. 8 *b*) is still further separated from this group by its deep byssal sinus.

P. nummularis, Fischer de Waldheim,[7] is a closely allied form, but without seeing a series of specimens I am unable to make a comparison.

P. (*Amusium*) *balticus*, Dames,[8] is probably identical with *P. orbicularis*.

[1] 'Prodr. de Pal.,' vol. ii (1850), p. 139.

[2] "Faune du Gault de Cosne," 'Mém. Soc. Pal. Suisse,' vol. ix, 1882, p. 84, pl. x, fig. 6.

[3] 'Palæont. Indica, Cret. Fauna S. India,' vol. iii (1871), p. 436, pl. xxxi, figs. 12, 17.

[4] 'Mollusk. Untersenon von Braunschweig u. Ilsede' (1898), p. 34, pl. v, fig. 9.

[5] 'Petrif. Succ.' (1827), p. 23, pl. ix, fig. 16 (lower figure). See also Hennig, Holzapfel, Zittel, Geinitz, Goldfuss, etc.

[6] 'Petref. Germ.,' vol. ii (1836), p. 76, pl. xcix, fig. 8.

[7] Fischer de Waldheim, 'Bull. Soc. Imp. Nat. de Moscou,' vol. xvi (1843), p. 135, pl. v, fig. 4; d'Orbigny, in Murchison, de Verneuil, and Keyserling, 'Géol. de la Russie,' vol. ii (1845), p. 475, pl. xli, figs. 20—23, and figs. 16—19 (*P. demissus*); d'Orbigny, 'Prodr. de Pal.,' vol. i (1849), p. 373; Trautschold, 'Bull. Soc. Imp. Nat. de Moscou,' vol. xxxviii (1865), p. 23, pl. iii, fig. 2; Nikitin, "Les Vestiges de la Période Crét. dans la Russ. Centrale," 'Mem. Com. Géol.,' vol. v, 1888, p. 73; *P. demissus*, Trautschold, 'Bull. Soc. Imp. Nat. de Moscou,' vol. xxxiv (1861), p. 268, pl. vii, fig. 4.

[8] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxvi (1874), p. 762, pl. xxi, fig. 1. Nötling, "Baltischen Cenoman.," 'Palæont. Abhandl.,' vol. ii, p. 17, pl. ii, fig. 7.

Remarks.—The appearance of the shell differs considerably according to the state of preservation; the *fine* concentric grooves on the right valve are seen chiefly when the outermost layer of the shell has been removed; when a thicker layer has disappeared this valve may become almost smooth.

This is one of the commonest and most widely distributed of the Cretaceous Pectens; it varies considerably in size, in proportions, in the number of concentric ribs, and also to some extent in convexity. Some of the varieties are more abundant at certain horizons than elsewhere, but are seldom, if ever, limited to one level, and are doubtless accounted for by the varying conditions under which the deposits were laid down. Some of these varieties are here briefly noticed.

1. *Tealby Limestone* (zone of *Bel. brunsvicensis*).—The forms found at this horizon never reach a large size (Pl. XXVII, figs. 1, 2), and on the average are smaller than those found in the Cenomanian; they are also slightly higher in proportion to their length, and often rather more convex. The number of concentric ribs is not so great as in many Upper Greensand and Cenomanian forms. Near the umbo there is usually seen a fairly large, smooth portion of the shell without ribs, which at first sight appears to be a distinguishing feature of the forms from this horizon. But the examination of a large series of specimens shows that this is due to imperfect preservation; the same feature has been noticed by Dr. Wollemann in Brunswick specimens. The size of this smooth area varies very considerably in different specimens, and occasionally nearly all the concentric ribs have disappeared; moreover, an identical smooth portion is sometimes seen in specimens from the Gault and Chalk Marl.

2. *Folkestone Beds.*—Forms very similar to those from the Tealby Limestone and of about the same size occur in the Folkestone Beds of Folkestone, but do not appear to be numerous. The number of ribs is sometimes greater, sometimes less than in the Tealby specimens.

3. *Gault.*—The forms in the Gault (Pl. XXVII, fig. 3) are, on the average, of about the same size as the Tealby specimens, but some larger examples also occur; they sometimes possess rather more numerous ribs, and in some cases the valves are quite as convex as in the Tealby forms, but usually rather less.

4. *Upper Greensand.*—The forms from Ventnor are noteworthy for the large size which they reach; the number of concentric ribs is variable, and on the largest specimens the later part of the valve (Pl. XXVII, fig. 7*a*) is smooth and without ribs, and in the ribbed part two distinct stages may sometimes be noticed, an earlier with close-set ribs, a later with more widely separated ribs (Pl. XXVII, figs. 8, 9). Sometimes the grooves are widely spaced and the ribs broad (fig. 9*a*).

P. orbicularis seems to be rare at Blackdown, and the forms seen are rather small, with numerous ribs. The examples from the Chert Beds of Haldon (Pl. XXVII, fig. 4), of which there is a good series in the Exeter Museum, have the

ears much larger than usual, also a smaller apical angle, and straight antero- and postero-dorsal margins; the shell is rather high in proportion, and the ribs are numerous. Since all the Haldon specimens agree in these respects, and are readily distinguishable from those found elsewhere, they may be regarded as a local variety, and named *P. orbicularis*, var. *haldonensis*: this variety resembles the form from the Cenomanian of Bavaria figured by Söhle (1897). The forms found in the Upper Greensand of Warminster are rather larger than most of those in the Gault and Lower Cretaceous, and often have numerous ribs.

5. *Cenomanian.*—Small forms, with a variable number of ribs, occur commonly in the Chalk Marl, and rarely also a very large variety, sometimes reaching 76 mm. in height (Text-fig. 1). In the *H. subglobosus* zone the average size is rather

Fig. 1.—*Pecten (Syncyclonema) orbicularis*, Sow. Chalk Marl, Folkestone. Woodwardian Museum. Natural size.

larger than in Gault and Lower Cretaceous, but no forms as large as those in the Upper Greensand mentioned above have been seen. The number of ribs is variable.

Types.—The type, from the Upper Greensand of Devizes, appears to have been lost, and the same is the case with the types of *P. laminosus* from the Chalk Marl of Hamsey and Stoneham.

Distribution.—Folkestone Beds of Folkestone. Lower Greensand of Upware. Spilsby Sandstone of Donnington and Spilsby. Claxby Ironstone of Benniworth Haven. Tealby Limestone (zone of *B. brunsvicensis*) of North Willingham and Claxby. Speeton Series (same zone) of Speeton (*fide* Lamplugh).

Also recorded in the Geological Survey Memoirs from the *Perna*-bed of Ather-

field and Sandown; the Ferruginous Sands of Shanklin; the Carstone of Bonchurch, etc.; the Hythe Beds of Hythe, Maidstone, Godalming, and Pulborough; and the Sandgate Beds of Sandgate and Parham. I have not seen the specimens on which these records are based.

Gault of Folkestone (zones i—iii, ix—xi), and Black Ven. Zone of *H. interruptus* of Okeford Fitzpaine. Recorded by the Geological Survey from the Gault of Compton Bay, Culver, Blackgang, Niton, and Bonchurch, and from the Red Limestone of Hunstanton. Cambridge Greensand (derived from the Gault). Upper Greensand (zone of *Schlænbachia rostrata*) of Blackdown, Devizes, Ventnor, Selborne, and the Devon coast. Upper Greensand (zone of *Pecten asper*) of Haldon, Warminster, Ventnor, and Niton.

Chloritic Marl of Maiden Bradley and Ventnor. Chalk Marl of Folkestone, Hamsey, Blue Bell Hill (Burham), Burwell, Madingley, and Hauxton. Cenomanian of Wilmington. Lower Chalk (? Chalk Marl) of Stoke Ferry. Totternhoe Stone of Cherry Hinton, Fulbourn, and Burwell. Zone of *H. subglobosus* of Cherry Hinton.

PECTEN, sp., cf. NILSSONI, *Goldfuss*, 1836.

A species, apparently belonging to this group, has been found by Mr. R. M. Brydone in the Chalk of Trimingham; it has a smooth, or nearly smooth, thin shell, with nearly equal ears, and seems to agree with *P. Nilssoni*, Goldfuss,[1] but I am unable to say whether it possesses a byssal sinus as is shown in the figures of Goldfuss and Ravn. It also resembles *P. membranaceus*, Nilsson (see p. 149), but appears to have been proportionately longer, and has consequently a larger apical angle and smaller ears. Only three incomplete specimens have been seen, the largest having a length of about 53 mm.

Sub-genus—CAMPTONECTES (*Agassiz* MS.), *F. B. Meek*, 1864.

('Check List of Invert. Foss. N. America, Cret. and Jur.,' Smithson, Misc. Coll. 177, pp. 28, 39.)

PECTEN (CAMPTONECTES) CINCTUS, *Sowerby*, 1822. Plate XXVIII; and Text-fig. 2.

1822. PECTEN CINCTUS, *J. Sowerby*, Min. Conch., vol. iv, p. 96, pl. cccl xxi.
1825. — — *Defrance*. Dict. Sci. nat., vol. xxxviii, p. 254.

[1] Müller (1827), p. 23, pl. x, fig. 12. Goldfuss, vol. ii (1836), p. 76, pl. xcix, fig. 8. Hennig (1897), p. 45, pl. iii, figs. 18, 19. Vogel (1895), p. 21, pl. i, fig. 17. Ravn (1902), p. 9, pl. ii, figs. 3—5. See also Römer (1841), Reuss (1846), Favre (1869), Geinitz (1872), Brauns (1876), Fritsch (1877–97), Behrens (1878), Griepenkerl (1889), Stolley (1892), Leonhard (1897).

1839. PECTEN CRASSITESTA, *F. A. Römer.* Verstein. nord-deutsch. Oolith.-geb. Nachtrag, p. 27.
1841. — CINCTUS, *F. A. Römer.* Die Verstein. nord-deutsch. Kreidegeb., p. 50.
1846. — IMPERIALIS, *A. Keyserling.* Petschoraland, p. 295, pl. xv.
1847. — CRASSITESTA, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 584, pl. cccexxx, figs. 1—3.
? 1854. — CINCTUS, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 176 (not from the locality and horizon given).
? — — CRASSITEST[A], *Morris.* Ibid., p. 176.
1868. — — *E. Eichwald.* Lethæa Rossica, vol. ii, p. 427.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 212.
1871. — (PSEUDAMUSIUM) CRASSITESTA, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.
1884. — CRASSITESTA, *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palaeont. Abhandl., vol. ii), p. 53.
— — ROEMERI, *Weerth.* Ibid., p. 54.
1895. — (SYNCYCLONEMA) CRASSITESTA, *F. Vogel.* Holländ. Kreide, p. 54.
— — CRASSITESTA, *G. Maas.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 299.
1896. — — *A. Wollemann.* Ibid., vol. xlviii, p. 838.
1899. — — *G. Maas.* Ibid., vol. li, p. 249.
1900. — — *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 39.

Description.—Shell very large, stout, rather convex, oval or nearly circular, almost equilateral, length sometimes a little greater than height, sometimes a little less. Umbo pointed, with the margins on each side straight or slightly concave. Apical angle from 133° to 144° in the longer forms; from 120° to 127° in the shorter and higher forms. Ears long and low, unequal.

Right valve moderately convex, with a nearly smooth surface; ornamented with very regular concentric linear grooves between which are flat interspaces, the ventral edges of which are sometimes produced as laminæ over the grooves. The interspaces are crossed by numerous radial striæ, which sometimes extend only part of the distance from one concentric groove to the next; also faint concentric ridges are sometimes seen. Anterior ear larger than posterior, with a well-marked byssal sinus, ornamented with close-set sinuous ridges. Posterior ear with the outer angle rectangular or slightly obtuse, ornamented with ridges crossed by radial striæ.

Left valve more convex than the right, with similar ornamentation, but having the concentric grooves more distinct, the laminæ often more prominent, and the

radial striæ usually less distinct and sometimes absent except near the umbo. Ears slightly unequal, with ridges and radial grooves.

Measurements:

	A							B						
	(1)	(2)	(3)	(4)	(5)	(6)		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length .	57	118	118	120	132	191	...	52	150	191	195	204	212	231 mm.
Height .	62	125	129	127	145	207	...	52	145	179	184	192	201	226 ,,

A. The higher and shorter forms. (1) Tealby Limestone: (2–6) Claxby Ironstone.
B. The lower and longer forms. (1) Tealby Limestone: (2—7) Claxby Ironstone.

Affinities.—Goldfuss' *P. circularis*[1] was regarded by Römer and Bronn as identical with *P. crassitesta*, Römer; subsequently both were considered by Römer as synonyms of *P. cinctus*, Sowerby. The example figured by Goldfuss is stated by him to have come from the Greensand of Dorsetshire; but no species of this type appears to have been found in the Greensand of that district, whereas the similar form *P. lamellosus*, Sowerby, from the Portlandian, is common there, and Goldfuss' figure agrees more closely with that than with *P. cinctus:* this view was evidently held by Morris, since he gives *P. circularis* as a synonym of *P. lamellosus*. *P. lamellosus*, Sowerby,[2] is undoubtedly closely allied to *P. cinctus;* the ornamentation is practically identical in both, for although the radial striæ on the former are usually less distinct in specimens from the Portland Limestone, they are quite as well-marked in specimens from the Portland Clay as in *P. cinctus*. *P. lamellosus* may, however, be distinguished by its greater obliquity, smaller apical angle, and proportionately higher ears (especially the anterior). The shell never attains the same size as *P. cinctus*, its average being much less; the height appears to be nearly always greater than the length.

Remarks.—There are two forms of this species which differ in the proportions of length and height, as will be seen from the figures, and from the measurements (A and B) given above. In one (A) the height is greater than the length, and the valves are oval in outline, with a smaller apical angle and more elevated ears (Text-fig. 2). The right valve is rather more convex than in the other form. This form (A) was figured by Sowerby as *P. cinctus*. In the other form (B) the length is greater than the height, and the valves are more nearly circular in outline, with a larger apical angle and lower ears. The convexity of the valves is less, and the anterior and posterior parts are more compressed (Pl. XXVIII). This form was figured by d'Orbigny as *P. crassitesta*.

Since the forms A and B agree in all the details of ornamentation, and also

[1] 'Petref. Germ.,' vol. ii (1836), p. 76, pl. xcix, fig. 10.

[2] 'Min. Conch.,' vol. iii (1819), p. 67, pl. ccxxxix. See also de Loriol and Pellat, "Mon. de l'étage Portlandien de Boulogne-sur-Mer" ('Mém. Soc. Phys. et d'Hist. nat. de Genève,' vol. xix, 1866), p. 103, pl. x, fig. 4.

occur on the same geological horizons, and since each shows some variation in the proportions of length and height, there seems no reason to regard them as more than varieties of one species.

The concentric grooves are generally more widely separated in the specimens from the Speeton Clay than in those which come from the Claxby Ironstone.

This species has usually been known on the Continent as *P. crassitesta*, owing, no doubt, to the fact that the type of *P. cinctus* came from the Drift, and its true horizon was for some time thought to be Middle Jurassic; also to the fact of its

Fig. 2.—*Pecten* (*Camptonectes*) *cinctus*, Sow. Claxby Ironstone, Claxby. Woodwardian Museum. The higher and shorter form of the species. × ⅔.

being the form with a higher shell, which is rather less common than the other variety.

Type.—In the British Museum; from the Drift—probably derived from the Claxby Ironstone.

Distribution.—Claxby Ironstone (zone of *Bel. lateralis*) of Claxby, North Willingham, Tealby, Donnington. Tealby Limestone (zone of *Bel. brunsvicensis*) of Claxby. Speeton Series (zone of *Bel. jaculum*, D 1, D 4, D 5) of Speeton.

PECTEN (CAMPTONECTES) COTTALDINUS, *d'Orbigny*, 1847. Plate XXIX, figs, 1, 2 *a*, *b*, 3 *a*, *b*.

1845.	PECTEN CIRCULARIS,	*E. Forbes.*	Quart. Journ. Geol. Soc., vol. i, p. 249 (*non* Goldfuss).
1847.	—	COTTALDINUS, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 590, pl. cccexxxi, figs. 7—11.
1850.	—	— —	Prodr. de Pal., vol. ii, p. 83.
1855.	—	— *G. Cotteau.*	Moll. Foss. de l'Yonne, p. 115.
1861.	—	— *P. de Loriol.*	Anim. Invert. Foss. Mt. Salève, p. 103, pl. xiii, fig. 3.
1868.	—	— *F. J. Pictet.*	Mélanges Paléont., pt. 4, p. 261, pl. xl, figs. 6, 7.
—	—	— *E. Eichwald.*	Lethæa Rossica, vol. ii, p. 431.
1870.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 197, 212, pl. clxvii, fig. 3.
? 1871.	—	— *W. A. Ooster.*	Protozoe Helvetica, vol. ii, pp. 105, 125, 141.
—	—	(SYNCYCLONEMA) COTTALDINUS, *F. Stoliczka.*	Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.
1900.	—	COTTALDINUS, *G. Müller.*	Verstein. d. Jura u. d. Kreide. In W. Bornhardt, Zur Oberflächen u. Geol. Deutsch-Afrikas (Deutsch-Ost-Afrika, vol. vii), p. 551.
Non 1895.	—	— *G. Maas.*	Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 269.

Description.—Shell ovate, rather higher than long, inequilateral; antero-dorsal margin slightly concave, and longer than the postero-dorsal, which is slightly convex. Convexity of valves small. Ears very unequal.

Right valve slightly convex; surface almost smooth, ornamented with numerous fine, regular, concentric grooves, which become more closely placed in passing from the umbo to the margin of the valve. The interspaces are flat and sometimes produced as slightly projecting laminæ next the concentric grooves. Near the umbo the interspaces are crossed by very fine, close-set radial striæ. Anterior ear large, produced, with a very deep byssal sinus, and a sulcus near the junction of the ear and valve; surface with many concentric narrow ridges. Posterior ear small, triangular, outer angle slightly obtuse, with concentric ornament.

Left valve moderately convex, with ornamentation similar to that of the right, but the concentric grooves are rather more distinct and not so close together; the radial striæ are more distinct and cover a larger part[1] of the valve. Anterior ear large, triangular, outer angle about 90°, height nearly or quite equal to length, with concentric ridges and radial striæ. Posterior ear much smaller and lower.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	35·5	45	49	53	57	76	mm.
Height	37	49	54	56	60	78·5	„

(1—5) *Perna*-bed of Atherfield.
(6) Lower Greensand of Whale Chine.

Affinities.—This species is allied to *P. cinctus*, but differs in being less convex, higher than long, distinctly inequilateral, smaller, in having the concentric grooves, and usually also the radial striæ closer together, the ears more unequal, and the byssal sinus deeper.

Remarks.—A few small specimens (10 to 17 mm. long) from the Atherfield Beds of East Shalford, in the Meÿer Collection, may be young examples of *P. Cottaldinus*, but they also closely resemble *P. Greppini*, Pictet and Renevier.[2]

Types.—D'Orbigny's specimens came from the Neocomian of Auxerre, etc. The specimen referred to *P. circularis* by Forbes is in the Museum of the Geological Society (No. 2030).

Distribution.—*Perna*-bed of Atherfield. Lower Greensand (either *Scaphites* or Lower *Crioceras* Groups of Fitton) of Whale Chine. Recorded by Topley (1875) from the Atherfield Beds of Peasmarsh and Shalford.

PECTEN (CAMPTONECTES) STRIATO-PUNCTATUS, *Römer*, 1839. Plate XXIX, figs. 4*a*,*b*, 5, 6.

1839.	PECTEN STRIATO-PUNCTATUS,	*F. A. Römer.*		Die Verstein. d. nord-deutsch. Oolith.-geb. Nachtrag., p. 27.
1841.	—	—	—	Die Verstein. d. nord-deutsch. Kreidegeb., p. 50.
1847.	—	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 592, pl. cccexxxii, figs. 4—7.
1850.	—	—	—	Prodr. de. Pal., vol. ii, pp. 83, 119.

[1] Perhaps the whole in perfectly preserved specimens.

[2] 'Foss. Terr. Aptien de la Perte du Rhone, etc.' (1858), p. 134, pl. xix, fig. 4. Pictet and Campiche, 'Terr. Crét. de Ste. Croix' (1870), p. 198.

1854. Pecten striato-punctatus, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 177.
1868. — arzierensis, *P. de Loriol.* Valangien d'Arzier, p. 47, pl. iv, figs. 3—5.
1870. — striato-punctatus, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 196, 211, pl. clxxi, figs. 4, 5.
— — arzierensis, *Pictet and Campiche.* Ibid., pp. 195, 211, pl. clxxi, fig. 3.
1871. — (Camptonectes) striato-punctatus, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.
1877. — striato-punctatus, *G. Böhm.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxix, p. 233.
1884. — — *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palaeont. Abhandl., vol. ii), p. 53.
1888. — arzierensis, *S. Nikitin.* Les Vest. de la Pér. Crét. dans la Russ. centrale (Mém. Com. Géol., vol. v), p. 73, pl. ii, fig. 12.
1889. — lens, var. morini, *G. W. Lamplugh.* Quart. Journ. Geol. Soc., vol. xlv, p. 615.
1895. — (Camptonectes) striato-punctatus, *F. Vogel.* Holländ. Kreide., p. 54.
1896. — striato-punctatus, *A. Wollemann.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 840.
1900. — — — . Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 49.
? 1900. — — *G. Müller.* Verstein. d. Jura u. d. Kreide. In W. Bornhardt, Zur Oberflächen u. Geol. Deutsch-Afrikas (Deutsch-Ost-Afrika, vol. vii), p. 550, pl. xxiv, fig. 7.

Description.—Shell ovate, a little higher than long, nearly equilateral, convexity small, margins rounded, dorsal portion pointed. Ears unequal.

Right valve flattened, anterior ear with a deep sinus. Left valve rather more convex, anterior ear with the outer angle nearly rectangular, posterior ear with obtuse outer angle.

Both valves ornamented with numerous flattened radial ribs, which curve outwards from the median part of the valves, and sometimes bifurcate, or have new ribs intercalated. Ribs separated by narrow, sharply marked punctate grooves. At intervals a few distinct growth-lines occur. Ears with radial ribs crossed by concentric growth-ridges.

Measurements :

	(1)	(2)	(3)	(4)
Length	36	25	22	15 mm.
Height	40	27	26	19 ,,

(1) *B. lateralis* zone, Speeton.
(2, 3) *B. jaculum* zone, Speeton.
(4) Claxby Ironstone, Benniworth Haven.

These measurements are approximate only, on account of the imperfection of the specimens. Considerably larger examples than (4) occur in the Claxby Ironstone.

Affinities.—I have seen only a few specimens of this species, and most of them are very imperfect, consequently I am unable to make a detailed comparison with allied forms. The species which appears to approach most nearly *P. striato-punctatus* is *P. Morini*, de Loriol;[1] it is found in the Portlandian of Swindon, Hartwell, etc., and seems to differ from *P. striato-punctatus* in being less equilateral, owing to the greater proportionate length and inward curvature of the antero-dorsal margin; the ribs are also, on the average, more numerous and closer together, but vary somewhat in this respect.

P. virgatus, Nilsson, and *P. curvatus*, Geinitz (see below), are also related to *P. striato-punctatus*.

Remarks.—Römer figured no examples of this species, but erroneously referred to Goldfuss' figure of a Jurassic form (*P. lens*). A small form found rarely in the Gault of Folkestone is perhaps referable to *P. striato-punctatus*.

Types.—From the Hils-conglomerate and Hils-clay of Schandelah, Schoppenstedt, and Elligser Brink. D'Orbigny's specimens were obtained from the Aptian of St. Dizier (Haute Marne).

Distribution.—Speeton Clay (zones of *B. lateralis*, D 1, and of *B. jaculum*, C 11) of Speeton. Claxby Ironstone (zone of *Bel. lateralis*) of Benniworth Haven. ? Upper Gault (zone viii) of Folkestone.

Recorded by Topley (1875) from the Atherfield Beds of Peasmarsh and East Shalford, and from the Folkestone Beds of Folkestone. Recorded by Morris from the Lower Greensand of Folkestone.

PECTEN (CAMPTONECTES) CURVATUS, *Geinitz*, 1843. Plate XXIX, figs. 7 *a*, *b*; Plate XXXVII, fig. 16.

1833. PECTEN ARCUATUS, *A. Goldfuss.* Petref. Germ., vol. ii, p. 50, pl. xci, fig. 6 (*non* Nilsson).
? 1841. — — *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 51.

[1] De Loriol and Pellat, "Portlandien de Boulogne-sur-Mer" ('Mém. Soc. Phys. et d'Hist. nat. Genève,' vol. xix, 1866), p. 107, pl. x, fig. 6.

1842. Pecten striato-punctatus, *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 83.

? 1843. — curvatus, *H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 16, pl. iii, fig. 13.

1846. — divaricatus, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 28, pl. xxxix, fig. 6.

? — arcuatus, *Reuss.* Ibid., p. 27, pl. xxxix, fig. 7.

— curvatus, *H. B. Geinitz.* Grundr. der Verstein., p. 468.

? 1847. — arcuatus, *J. Müller.* Petref. der Aachen. Kreidef., pt. 1, p. 32.

— virgatus, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 602, pl. cccexxxiv, figs. 7—10.

1848. — curvatus, *H. G. Bronn.* Index Palæont., vol. i, p. 922.

1850. — virgatus et curvatus, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb in Deutschland, p. 180.

? — — curvatus, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 197.

? — — divaricatus, *A. d'Orbigny.* Ibid , p. 252.

? 1870. — virgatus, *F. Römer.* Geol. von Oberschles., p. 333.

— — curvatus, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 217.

1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 193, pl. xliii, fig. 15.; pt. 2, p. 33, pl. x, fig. 1.

? 1876. — (Camptonectes) curvatus, *D. Brauns.* Zeitschr. f. d. gesammt. Naturwissensch., vol. xlvi, p. 390.

? 1877. — curvatus, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Die Weissenberg. und Malnitz. Schicht., p. 136, fig. 127.

? 1882. virgatus, *H. Schröder.* Zeitschr. d. deutsch. goel. Gesellsch., vol. xxxiv, p. 270.

? 1883. — curvatus, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: III, Die Iserschicht., p. 116.

1885. — (Camptonectes) divaricatus, *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palaeont. Abhandl., vol. ii), p. 17, pl. ii, fig. 6.

? Camptonectes curvatus, *J. Böhm.* Verhandl. des naturhist. Vereins d. Rheinl., vol. xlii, p. 78.

? 1887. Pecten (Camptonectes) curvatus, *F. Frech.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxix, p. 155, pl. xix, fig. 18.

? 1889. — virgatus, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 229, pl. xxvi, figs. 7—9.

? — (Camptonectes) virgatus, *O. Griepenkerl.* Die Verstein. der. Senon. von Königslutter (Palaeont. Abhandl., vol. iv), p. 46.

? — — curvatus, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat. IV, Die Teplitz. Schicht., p. 85.

1892. Pecten virgatus, *F. Vogel.* Verhandl. nat. Vereins d. preussisch. Rheinl., vol. xlix, p. 55.

? 1893. — cf. curvatus, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 236.

? — — curvatus, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: V, Priesen. Schicht., p. 100.

? 1895. — (Camptonectes) virgatus, *F. Vogel.* Holländisch. Kreide, p. 23.

? 1897. — curvatus, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: VI, Die Chlomek. Schicht., p. 68.

? — — virgatus, *A. Rutot.* Bull. Soc. Belge Géol., etc., vol. x, p. 30.

? — — — *R. Leonhard.* Die Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 26.

? 1900. — — *C. Gagel and F. Kaunhowen.* Jahrb. d. k. preussisch. geol. Landesanst. u. Bergakad. für 1899, p. 231.

Non 1827. — arcuatus, *S. Nilsson.* Petrif. Suecana, p. 22, pl. ix, fig. 4.

— — — virgatus, *Nilsson.* Ibid., p. 22, pl. ix, fig. 15.

— 1837. — — *W. Hisinger.* Lethæa Succica, p. 52, pl. xvii, fig. 3.

— — — arcuatus, *Hisinger.* Ibid., p. 52, pl. xvii, fig. 2.

? — 1846. — virgatus, *E. Forbes.* Trans. Geol. Soc., vol. vii, p. 154, pl. xv, fig. 22.

? — 1852. — — *F. Römer.* Die Kreidebild. von Texas, p. 66, pl. viii, fig. 5.

— 1866. — — *K. A. Zittel.* Die Biv. der Gosaugeb. II (Denkschr. d. k. Akad. Wissensch. Math.-nat. Cl. Wien, vol. xxv, pt. 2), p. 109 (33 of reprint), pl. xvii, fig. 8.

? — 1871. — (Camptonectes) curvatus, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 433, pl. xxxi, figs. 15, 16; pl. xli, figs. 4—6.

? — 1884. Camptonectes curvatus, *J. F. Whiteaves.* Mesozoic Fossils, vol. i, pt. 3 (Geol. and N. H. Survey, Canada), p. 242, pl. xxxii, fig. 4.

— 1897. Pecten virgatus, *A. Hennig.* Revis. Lamellibr. i Nilsson's 'Petrif. Suec.' (Kon. Fysiogr. Sällsk. Lund. Handl., N. F., vol. viii), p. 41, pl. ii, figs. 28, 33; pl. iii, figs. 32, 33.

Remarks.—This species closely resembles *P. striato-punctatus*, Römer, but generally possesses fewer ribs, and is, on the average, of smaller size. I have seen only two English specimens. One is a right valve from Great Haldon, 10 mm. in length and 11 mm. in height, with well-marked radial ribs on the ears crossed by much smaller concentric ribs. Another example, from the Chloritic Marl of Eastbourne, is 9 mm. in length and also in height. Without more English specimens, and without the opportunity of comparing them with collections of the foreign forms described as *P. virgatus*, etc., it is useless to attempt to discuss the relation of this to other Upper Cretaceous species.

Distribution.—Upper Greensand of Great Haldon. Chloritic Marl of Eastbourne.

PECTEN (CAMPTONECTES) DUBRISIENSIS, sp. nov. Plate XXIX, figs. 8 *a*—*c*.

Description.—Shell ovate, height a little greater than length, almost equilateral, margins evenly rounded. Umbones pointed. Apical angle about 117°. Ears rather large, unequal.

Right valve flattened, nearly smooth, with a few radial ribs near the antero-dorsal border, and occasional fine curving radial ornamentation like that on the left valve. Antero-dorsal margin slightly concave. Anterior ear long, with a deep byssal sinus, very sinuous growth-lines, and well-marked growth-ridges. Posterior ear triangular, with radial ribs and grooves.

Left valve moderately convex—the convexity greatest in the dorsal third, the ventral portions more compressed. Greater part of the surface smooth or nearly smooth; a few faintly marked growth-lines. Ornamentation seen on the sides of the umbonal region, also at the ventral edge, and for a short distance on the inner margin of some of the growth-lines; it consists of faintly marked outwardly curving ribs, separated by very narrow grooves, which are somewhat irregular and (in well-preserved specimens) punctate. Anterior ear large, not sharply separated from the rest of the valve, ornamented by a continuation of the radial ribs and grooves of the umbo, some of which cut the dorsal margin obliquely; the ribs are crossed by faint growth-ridges. Posterior ear smaller with similar ornamentation.

Measurements:

	(1)	(2)	(3)	(4)
Length	58	58	42	32 mm.
Height	63	59·5	46	35 ,,

(1) Totternhoe Stone, Cherry Hinton.
(2) Chalk Marl, Burham.
(3) Totternhoe Stone, Burwell.
(4) *H. subglobosus* zone, Hitchin.

Affinities.—The ornamentation is much less developed than in *P. striato-punctatus*; the shell is also larger, with a wider apical angle, less elevated ears, and with the left anterior ear indistinctly limited.

Remarks.—This is a comparatively rare form, which appears to be confined to the Chalk Marl and the zone of *H. subglobosus*.

Type.—Chalk Marl of Dover, British Museum, No. 38243.

Distribution.—Chalk Marl of Dover and Blue Bell Hill, Burham. Totternhoe

Stone of Cherry Hinton and Burwell. Zone of *H. subglobosus* of Hitchin. Lower Chalk of West Row near Mildenhall, and Stoke Ferry.

PECTEN (CAMPTONECTES?) GAULTINUS, sp. nov. Plate XXX, figs. 1 *a*, *b*, 2.

Description.—Shell small, oval, a little higher than long, convexity small; somewhat inequilateral, the antero-dorsal border slightly concave and longer than the postero-dorsal, which is slightly convex. Ears very unequal. Apical angle from 95° to 100°.

Right valve flattened, nearly smooth, with faintly marked, nearly straight radial ribs near the anterior and posterior borders, separated by narrow punctate grooves; ribs and grooves absent or indistinct on the middle of the valve, except near the umbo. Anterior ear long, with a deep sinus, and three or four radial ribs crossed by growth-ridges. Posterior ear small, with its outer angle obtuse.

Left valve rather more convex, with similar ornamentation.

Measurements:

	(1)	(2)	(3)	(4)
Length	22	15	14	17 mm.
Height	19	17	16	19 „

(1—3) Gault, Black Ven.
(4) Gault, Folkestone.

Remarks.—This species differs from the typical *Camptonectes* in having the punctate grooves nearly straight instead of curving outwardly.

Types.—In the Woodwardian Museum, Cambridge.

Distribution.—Gault of Folkestone and Black Ven.

Sub-genus—CHLAMYS, *J. F. Bolten*, 1798.

('Museum Boltenianum,' p. 165.)

PECTEN (CHLAMYS) FISSICOSTA, *Etheridge*, 1881. Plate XXX, figs. 3, 4, 5 *a*, *b*, 6 *a*—*c*, 7, 8.

1881. PECTEN FISSICOSTA, *R. Etheridge*. In W. H. Penning and A. J. Jukes-Browne, Geol. of Cambridge (Mem. Geol. Survey), p. 141, pl. ii, fig. 1; pl. iii, fig. 1.

Description.—Shell ovate, slightly inequilateral; height greater than length, the difference increasing with age, usually in the proportion of 9 : 7 or 9 : 8, but in small specimens of 5 : 4·5. Valves compressed, the right flatter than the left; antero- and postero-dorsal margins nearly straight, the remainder regularly rounded and with corrugated edges. Apical angle about 90°, but larger (sometimes 100°) in small specimens. Ears unequal.

Right valve ornamented with strong, rounded, radial ribs, usually from sixteen to eighteen in number, but sometimes fewer or more (twelve to twenty-three). The ribs are separated by rather deep, rounded furrows, which are rather narrower than the ribs. At a distance from the margin of the valve, which varies in different specimens, some of the ribs are usually divided by a narrow groove, sometimes median, sometimes on one side; towards the umbo this groove becomes relatively more important, and divides the main rib into two equal and narrow ribs; and at the same time another similar rib may appear in the main furrow, giving the appearance of numerous slender ribs. All these ribs seem to die out before reaching the umbo, where the shell (to a length of about 5 mm.) is apparently smooth.[1] At distant intervals well-marked growth-ridges are seen, and also (in some cases) very fine concentric lines. The surface of both ribs and furrows (but especially the latter) is covered by close-set radial striæ, which at the middle of the valve are parallel with the main ribs, but, in passing to the anterior and posterior margins, become more and more oblique to the main ribs, and also more irregular and less continuous. Anterior ear large, produced, with a deep byssal sinus; surface with sinuous growth-lines (some strong), and two or three faintly marked radial ribs at the middle of the ear near its apex. Posterior ear smaller, not produced, triangular, with from seven to nine faintly marked radial ribs and growth-lines (two or three being strong); on the ventral part of the ear the fine striæ of the rest of the shell are continued, and cut the ribs obliquely.

Left valve with ribs similar to those of the right, but rather narrower, and separated by broader furrows. The ribs are sometimes divided by a small groove, which may reach the margin of the valve. In the main furrows there is frequently a small radial rib, which often ends at varying distances from the margin, but sometimes is continued, becoming stronger. Close-set radial striæ, like those on the right valve, occur on both ribs and grooves. Fine concentric ribs occur in places, especially on the earlier parts of the valve, and also, at intervals, strong growth-ridges. Ears triangular; the anterior larger, and with radial ribs and growth-lines; the posterior nearly smooth and with faint ribs.

[1] This may, however, be due to imperfect preservation.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	45	40	36	36	35	27	26	mm.
Height	52	47	44·5	44	42	31	29	,,

(1) Totternhoe Stone, Cherry Hinton.
(2—7) ,, ,, Burwell.

Affinities.—*P. fissicosta* is readily distinguished from the other species with strong ribs by its numerous radial striæ and by the fission of some of the main ribs. *P. landeronensis*, De Loriol,[1] resembles this species in form, but possesses a strongly marked concentric ornamentation. The radial striæ of *P. fissicosta* resemble those of *Camptonectes* as well as those seen in *P. Robinaldinus*, etc. The varieties, with few and undivided ribs (Pl. XXX, fig. 7), approach *P. decemcostatus*, Goldfuss (references on p. 167), but the valves are higher.

Types.—From the Totternhoe Stone, Burwell; in the Woodwardian Museum.

Distribution.—Chloritic Marl of Ventnor. Chalk Marl of Eggardon Hill (Dorset), Folkestone, and Blue Bell Hill, Burham. Totternhoe Stone of Arlesey, Cherry Hinton, Burwell, Orwell, and Stoke Ferry. Zone of *H. subglobosus* of Cherry Hinton.

PECTEN (CHLAMYS) PUZOSIANUS, *Matheron*, 1842. Plate XXX, figs. 9 *a*, *b*, 10 *a*, *b*, 11, 12.

1842.	PECTEN PUZOSIANUS,	*P. Matheron.*	Catal. Foss. des Bouches-du-Rhône, p. 185, pl. xxx, figs. 1—3.
1847.	—	—	*A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 610, pl. cccexxxvii, figs. 1—4.
1850.	—	—	—	Prodr. de Pal., vol. ii, p. 197.
1870.	—	—	*F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 215.
1896.	—	cf. PUZOSIANUS,	*A. J. Jukes-Browne and W. Hill.*	Quart. Journ. Geol. Soc., vol. lii, p. 151.

Description.—Shell ovate, higher than long, nearly equilateral and equivalve, dorsal portion pointed; antero- and postero-dorsal margins long. Convexity small, valves bent near the antero- and postero-dorsal margins. Apical angle about 90°. Ears large, unequal.

Right valve slightly convex, with numerous narrow ribs, which on the mid-dorsal parts of the valve are alternately large and small, but elsewhere become

[1] De Loriol and Gilliéron, 'Urgon. Infér. de Landeron' (1869), p. 22, pl. i, fig. 19; Pictet and Campiche, "Terr. Crét. de Ste. Croix" ('Matér. Pal. Suisse,' ser. 5, 1870), p. 187, pl. clxix, figs. 6, 7.

more nearly equal in size. Surface with concentric ridges or growth-lines, which sometimes develop into small spiny projections where they cross the ribs. Anterior ear large, rising dorsally, with a deep byssal sinus.

Left valve rather more convex, with usually from thirty-eight to forty-four ribs at the margin, where they are separated by very narrow grooves. Most of the ribs are of nearly equal size, but occasionally smaller ones occur; they are rounded on the early parts of the valve, but become flattened and broader ventrally, and also anteriorly and posteriorly. Secondary ribs are introduced at a short distance from the umbo. The grooves become narrow ventrally. Surface of ribs and grooves with close-set, concentric, linear ribs, which are better marked near the umbo than elsewhere. The bent antero- and postero-dorsal margins are without ribs, but have numerous radial striæ; these striæ appear on some of the ribs also. Anterior ear more elevated and larger than the posterior; both with a few broad radial ribs.

Measurements :

	(1)	(2)	(3)
Length	42	39	35 mm.
Height	50	49	42 ,,

(1) Cenomanian (Bed 11), Dunscombe.
(2) Cenomanian, Wilmington.
(3) Cenomanian (*A. Mantelli* zone), Beer Head.

Affinities.—The ribs in this species are more numerous as a rule, and the concentric ornamentation much less well-developed than in *P. Espaillaci*, d'Orbigny. The ribs are much more numerous than in *P. fissicosta*, Etheridge, and the radiating striæ much less developed, being apparently confined to the anterior and posterior part of the valves.

Remarks.—The English specimens are smaller than those figured by Matheron and d'Orbigny, and, as pointed out by Jukes-Browne, agree better with the figures than with the descriptions given by those authors, but specimens obtained from France leave no doubt as to the identity of the English form with Matheron's species. I have not seen the arrangement of the ribs shown in Matheron's section (fig. 3), but there is sometimes an alternation of large and small ribs.

Types.—Cenomanian (Chert Beds) of Les Martigues, Uchaux, and Mornas Sault.

Distribution.—Cenomanian of Wilmington. Cenomanian (Beds 10, 11) of Beer Head, and (Bed 11) of Dunscombe. Chloritic Marl of Melbury (Dorset) and Maiden Bradley.

PECTEN (CHLAMYS) BRITANNICUS, sp. nov. Plate XXXI, figs. 1 *a*, *b*, 2 *a*, *b*.

Description.—Shell thick, ovate, flattened, with even margins, slightly inequilateral, antero-dorsal margin a little longer than the postero-dorsal, apical angle about 90°.

Left valve with sixteen or more (sometimes probably thirty) strong, rounded, radial ribs, separated by deep grooves, which are frequently as broad as or broader than the ribs. The ribs merge into the smooth margin of the shell; they do not bifurcate, and only rarely is a new rib introduced between two others. Both ribs and grooves are marked by concentric, linear ridges, which are more distinct in the grooves than on the ribs, and are placed close together at regular intervals; the ridges imbricate upwards. Anterior ear moderately large, with the outer angle nearly rectangular, and one or two radial ribs. Posterior ear not seen.

Right valve not seen.

Measurements:

Length	26·0 mm.
Height	28·5 „

From *M. cor-anguinum* zone, South Croydon.

Affinities.—This species resembles *P. Espaillaci*, d'Orbigny,[1] from the Senonian of Dordogne and Charente-Inférieure, but it differs from the French form in possessing fewer ribs, with a stouter shell and thick margin (instead of a sharp and corrugated edge); also in the concentric ridges imbricating upwards, instead of downwards. A specimen of *P. Espaillaci* from the Dordonian has been sent me by M. A. de Grossouvre, and its concentric ridges are much better developed on the ribs, and in places are more scale-like, than in our species.

P. decemcostatus, Goldfuss,[2] possesses fewer ribs and is apparently without the fine concentric ridges.

P. fissicosta, Etheridge (p. 163), presents some resemblance to this species, but is easily separated by the divided and usually fewer ribs; also by the corrugated margin and the much less distinct concentric ridges, and by the occurrence of fine radial striæ.

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 614, pl. cccexxxix, figs. 1—4; d'Orbigny, 'Prodr. de Pal.,' vol. ii (1850), p. 251; F. J. Pictet and G. Campiche, "Foss. Terr. Crét. Ste. Croix" ('Matér Pal. Suisse," ser. 5, 1870), p. 215.

[2] 'Petref. Germ.,' vol. ii (1833), p. 53, pl. xcii, fig. 2; Geinitz, 'Das Elbthalgeb. Sachsen,' pt. ii (1872), p. 35, pl. x, figs. 8, 9.

A specimen from Lewes, figured by Mantell,[1] may perhaps be an example of this species.

Remarks.—Only three specimens have been seen, all coming from nearly the same horizon. The number of ribs on those from Haling and Gravesend is fewer than on the specimen from Stratford, but in other characters they agree.

Types.—In Dr. Blackmore's collection, and in Mr. G. E. Dibley's collection.

Distribution.—*M. cor-anguinum* zone of Haling pit, South Croydon, of Gravesend, and of Stratford, near Salisbury.

PECTEN (CHLAMYS) MILLERI, *Sowerby*, 1836. Plate XXXI, figs. 3 *a*, *b*, 4, 5, 6 *a*, *b*.

1836.	PECTEN MILLERII, *J. de C. Sowerby.*	Trans. Geol. Soc., ser. 2, vol. iv, pp. 241, 342, pl. xvii, fig. 19.
1850.	— — *A. d'Orbigny.*	Prodr. de Pal., vol. ii, p. 169.
1854.	— MILLERI, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 176.
1870.	— — *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 214.

Description.—Shell rather small, ovate, nearly equilateral, the dorsal third narrowing rapidly; height greater than length. Margins well rounded, but the antero-dorsal and postero-dorsal more or less concave, and the former longer than the latter; inequivalve. Apical angle about 99°. Ears very unequal.

Right valve slightly convex, flattened, with numerous slightly elevated, rounded radial ribs, which are smooth or slightly scaly, and separated by broader, shallow grooves. Anterior ear long, with a well-marked sinus; posterior ear much smaller, triangular, with outer angle obtuse.

Left valve much more convex than the right, especially in the median line towards the umbo; ornamented with numerous (usually 45 to 54) radial ribs, which are slightly elevated, flattened or rounded, and smooth (except a few of the posterior ribs); on the dorsal part the furrows are narrower than the ribs, and pitted, but ventrally they may be broader, and are always shallow. A secondary rib may appear in the furrows towards the ventral border. Anterior ear considerably larger than the posterior, with seven or eight radial ribs and a few growth-lines; its outer angle almost rectangular. Posterior ear smaller, with obtuse outer angle.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	28	26	21	20	13	12	mm.
Height	32	29·5	24	23	15	14·5	,,

(1—6) All from Blackdown.

[1] 'Foss. S. Downs' (1822), p. 203, pl. xxv, fig. 6.

Remarks.—The right valve is less common than the left. The state of preservation of the shell, and consequently the appearance of the ornamentation, varies a good deal.

Type.—From Blackdown; in the Bristol Museum.

Distribution.—Blackdown Greensand (Bed 10). Recorded by Downes (1882) from Haldon, and by Jukes-Browne (1900) from the Upper Greensand of Lulworth and Warminster.

PECTEN (CHLAMYS) SUBACUTUS, *Lamarck*, 1819. Plate XXXI, figs. 7 *a*,*b*, 8 *a*—*c*, 9.

1819.	PECTEN SUBACUTUS, *Lamarck*.		Anim. sans Vert., vol. vi, p. 181.
1836.	—	— —	Ibid., ed. 2 (by Deshayes and Milne-Edwards), vol. vii, p. 158.
1847.	—	— *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 605, pl. cccxxxv, figs. 5—10.
? —	—	BRONGNIARTI, *A. d'Archiac.*	Mém. Soc. géol. de France, ser. 2, vol. ii, p. 310, pl. xvi, fig. 4.
1850.	—	— *H. B. Geinitz.*	Das Quadersandst. oder Kreidegeb. in Deutschland, p. 183.
1870.	—	SUBACUTUS, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste Croix (Matér. Pal. Suisse, ser. 5), pp. 214, 218.
1872.	—	— *H. B. Geinitz.*	Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 195, pl. xliv, fig. 5.
1877.	—	— *A. J. Jukes-Browne.*	Quart. Journ. Geol. Soc., vol. xxxiii, p. 501.
1896.	—	— —	*and W. Hill.* Ibid, vol. lii, p. 151.

Description.—Shell ovate, pointed dorsally, much higher than long, nearly equilateral, convexity small. Apical angle about 80°.

Right valve with about twenty-three strong ribs, which are straight or slightly curved, and have usually sharp summits, but are sometimes rounded; the grooves separating the ribs are broad, with rounded or angular bases. Near the anterior and posterior margins the ribs are rather smaller; near the umbo they are often more rounded than elsewhere. Both ribs and grooves are crossed by numerous, fine, close-set, wavy, laminar ridges, which are more regular and distinct near the umbo than ventrally. The ribs usually bear along their summits many scaly knobs or short spines, which are often distributed at fairly regular intervals; sometimes these scaly spines are absent over part or almost the entire shell. Anterior ear large, with a deep sinus; growth-ridges well-marked, radial ribs indistinct. Posterior ear much smaller, triangular, with radial ribs.

Left valve a little more convex, with similar ornamentation; ears slightly unequal.

Measurements:

	(1)	(2)	(3)
Length	37	34	24 mm.
Height	49	43	31 ,,

(1) Greensand, Haldon.
(2, 3) Chalk Marl (Bed 11), Dunscombe.

Affinities.—*P. acuminatus*, Geinitz,[1] resembles closely this species, but seems to differ from it in having few or no scaly spines on the ribs, and also in having the concentric ornament somewhat coarser; the ribs, as a rule, are also less sharp and somewhat less numerous. The state of preservation of the spines in *P. subacutus* varies a good deal in different specimens; in some cases (as in fig. 8) they are absent from the greater part of the surface. It seems probable, therefore, that the comparison of good series of specimens might show *P. acuminatus* and *P. subacutus* to be identical.

The form from the Cambridge Greensand, referred to this species by Jukes-Browne, possesses the characteristic concentric ornamentation, but has rather more numerous ribs; only three specimens have been seen, and since they are rather imperfectly preserved, the determination of the species cannot be regarded as quite certain.

Type.—From the Cenomanian of Le Mans.

Distribution.—Cenomanian:—Bed 10 of Hooken, Beds 11 and 12 of Dunscombe, Bed 12 of Branscombe. Greensand of Haldon. ? Cambridge Greensand.

PECTEN (CHLAMYS) ELONGATUS, *Lamarck*, 1819. Plate XXXI, figs. 10, 11 *a*,*b*, 12 *a*,*b*, 13; Plate XXXII, figs. 1 *a*,*b*, 2 *a*,*b*, 3 *a*,*b*.

1819. PECTEN ELONGATUS, *Lamarck*. Anim. sans Vert., vol. vi, p. 181.
1822. — OBLIQUUS, *J. de C. Sowerby*. Min. Conch., vol. iv, p. 95, pl. cccl.xx, fig. 2.

[1] Geinitz, 'Char. d. Schicht. u. Petref. des sächs-böhm. Kreidegeb.,' pt. 3 (1842), p. 84, pl. xxi, fig. 6; Reuss, 'Die Verstein. der böhm. Kreideformat.,' pt. 2 (1846), p. 29, pl. xxxix, figs. 20, 21; d'Archiac, 'Mém. Soc. géol. de France,' ser. 2, vol. ii (1847), p. 309, pl. xvi, fig. 3; Kunth, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xv (1863), p. 725; Michael, ibid., vol. xlv (1895), p. 235; Römer, 'Geol. v. Oberschles.' (1870), p. 333, pl. xxvi, fig. 3; Geinitz, "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx, pt. i, 1872), p. 194, pl. xliii, fig. 16; pl. xliv, fig. 1; Fritsch, 'Böhm. Kreideformat. III. Iserschicht.' (1883), p. 116, fig. 89; Nötling, "Die Fauna d. baltisch. Cenoman." ('Palaeont. Abhandl.,' vol. ii, 1885), p. 19, pl. iii, fig. 2; Leonhard, "Die Kreideformat. in Oberschles." ('Palæontographica,' vol xliv, 1897), p. 26.

1825. PECTEN ELONGATUS, *Defrance*. Dict. Sci. nat., vol. xxxviii. p. 265.
1833. — CRETOSUS, *A. Goldfuss* (non *Defrance*). Petref. Germ., vol. ii, p. 58, pl. xciv, fig. 2.
1836. — ELONGATUS, *Lamarck*. Anim. sans Vert., ed. 2 (by G. D. Deshayes and H. M. Edwards), vol. vii, p. 158.
1839. — CRETOSUS, *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 22.
1841. — CRISPUS, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 51.
— — COMANS, *Römer*. Ibid., p. 51, pl. viii, fig. 6.
1842. — FAUJASI, *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs.-böhm. Kreidegeb., pt. 3, p. 83.
— — COMANS, *Geinitz*. Ibid., p. 83.
1845. — FAUJASI, *H. B. Geinitz*. Grundriss der Verstein., p. 468.
— — CRISPUS, *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 30.
? 1847. — ELONGATUS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 607, pl. cccexxxvi, figs. 1—4.
— — RAULINIANUS, *d'Orbigny*. Ibid., p. 595, pl. cccexxxiii, figs. 6—9.
1850. — ELONGATUS, *d'Orbigny*. Prodr. de Pal., vol. ii, p. 169.
— CRISPUS, *d'Orbigny*. Ibid., p. 169.
— — RAULINIANUS, *d'Orbigny*. Ibid., p. 139.
— — ELONGATUS, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 182.
— — COMANS, *Geinitz*. Ibid., p. 180.
1853. — RAULINIANUS, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 510, pl. xlvi, fig. 2.
1854. — ELONGATUS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 176.
— MARROTIANUS, *Morris* (non *d'Orbigny*). Ibid., p. 176.
? — RAULINIANUS, *Morris*. Ibid., p. 177.
1870. — OBLIQUUS, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 214.
— — ELONGATUS, *Pictet and Campiche*. Ibid , pp. 214, 218.
— RAULINIANUS, *Pictet and Campiche*. Ibid., pp. 202, 213, pl. clxxii, figs. 5—7.
1872. — ELONGATUS, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 195, pl. xliv, figs. 2—4.
1876. CRISPUS, *H. Deicke*. Die Tourtia von Mülheim a. d. Ruhr, p. 26.
1877. — RAULINIANUS?, *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxiii. p. 501.
1878. ELONGATUS, *C. Barrois*. Ann. Soc. géol. du Nord, vol. v, p. 318 (foot-note 4).
1881. cf. ELONGATUS, *J. Kiesow*. Schrift. der naturf. Gesellsch. in Danzig, vol. v, p. 415, fig. 11.
1883. RAULINIANUS, *W. Keeping*. Foss., etc., Neoc. Upware and Brickhill, p. 104.

? 1885. PECTEN ELONGATUS, *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palaeont. Abhandl., vol. ii), p. 20, pl. iii, fig. 6.

1887. — — *A. Peron.* Hist. du Terr. de Craie (Bull. Soc. Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii), p. 163.

1893. — — *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 235.

1895. — (CHLAMYS) ELONGATUS, *E. Tiessen.* Ibid., vol. xlvii, p. 468.

1896. — ELONGATUS, *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 151.

1900. — — *Jukes-Browne.* Cret. Rocks of Britain (Mem. Geol. Survey), vol. i, p. 451.

Non 1833. — — *A. Goldfuss.* Petref. Germ., vol. ii, p. 59, pl. xciv, fig. 7.

— 1844. — — *F. M'Coy.* Carb. Limest. Foss. Ireland, p. 92, pl. xvi, fig. 9.

— 1846. — COMANS, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 29, pl. xxxix, fig. 13.

? — — — OBLIQUUS, *Reuss.* Ibid., p. 29, pl. xxxix, fig. 18.

— 1871. — ELONGATUS, *J. Phillips.* Geol. Oxford, etc., p. 441, pl. xvii, fig. 19.

Description.—Shell ovate, pointed dorsally, higher than long, of little convexity, nearly equilateral. Ears rather large, very unequal. Apical angle from 78° to about 90°.

Right valve flattened or slightly convex, ornamented with numerous ribs, which are frequently grouped in triplets—a larger central rib with a smaller on each side—but sometimes occur in pairs or singly. The smaller ribs appear at varying distances from the umbo in different specimens. Each rib bears many lappet-like scaly projections placed transversely; these are sometimes close together and arranged very regularly, but may be more distant and somewhat irregular. In places fine growth-ridges are present. The grooves between the ribs are rather narrow and rounded. Narrow portions of the valves at the antero- and postero-dorsal margins are without ribs, but are covered by numerous fine grooves placed nearly perpendicularly to the plane of junction of the valves. Ears with radial ribs, which are often indistinct, and with well-marked growth-lines; on the posterior ear striæ (like those on the margin of the valve) are sometimes seen crossing the ribs; anterior ear large with a deep sinus, posterior ear smaller, triangular.

Left valve of moderate convexity with ornamentation similar to that of the right valve. Ears triangular, with many spiny ribs; the anterior larger than the posterior.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	
Length	. 43	41	37	33	20	35	56	60	56	40	38	28·5	13	36	50	60	35	55	mm.
Height	. 53	51	47	41·5	25	44	65	73	66	50	49	34	17	47	58	74	45	65	

(1–5) Gault, Folkestone.
(6) Upper Greensand, Warminster.
(7) ,, ,, Ventnor.
(8) Malmstone, Wilton.
(9–13) Grey Chalk, Dover.
(14) Chalk Marl, Ventnor.
(15–17) Lower Chalk, Burwell.
(18) Totternhoe Stone, Arlesey.

Affinities.—The examples from the Gault (usually named *P. Raulinianus*) have been regarded as distinct from those found in the Upper Greensand and Chalk (*P. elongatus*); in the former the ribs usually appear to be more prominent owing to the longer and more pointed scales, and generally the triple arrangement of the ribs is not so well-marked as in the latter. The first difference is, I think, readily explained by the less perfect preservation of the spiny scales in specimens from the pervious beds of the Upper Greensand and Chalk; the triple arrangement of the ribs varies considerably in different specimens of *P. elongatus* from the Chalk and Greensand, and some forms with less regular triplets seem to be quite inseparable from the examples found in the Gault; on the other hand, a few Gault specimens have the triplets well and regularly developed. Mr. Jukes-Browne and Dr. F. L. Kitchin have examined carefully a number of specimens, and agree with me in considering that the differences between *P. elongatus* and *P. Raulinianus* are not of specific value.

P. Marrotianus, d'Orbigny,[1] from the Upper Senonian of Dordogne, resembles *P. elongatus*, but is apparently distinguished by the ears being less unequal, and by the anterior left ear having fewer and more distinct ribs; also the scales on the ribs of the valve are closer together and more numerous, and in the grooves between the triplets of ribs there are, in the adult, two small ribs.

P. Faujasi, Defrance,[2] from the *B. mucronata* Chalk of Maestricht, approaches very closely those forms of *P. elongatus* which have the triple arrangement of the ribs well developed, but appears to differ in having fewer ribs.

Remarks.—The specimens figured as *P. Raulinianus* by Pictet and Roux, and by Pictet and Campiche, seem to differ from the English forms in having fewer ribs; in this respect, however, the figures of those writers do not agree with their descriptions. But since Pictet and Campiche obtained specimens from Folkestone for comparison it is probable that their determination is correct. The example

[1] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 612, pl. cccexxxviii, figs. 1–6.

[2] Faujas-St.-Fond, 'Hist. Nat. de la Mont. de St. Pierre de Maestricht' (1799), p. 153, pl. xxiv, fig. 5; Defrance, 'Dict. Sci. nat.,' vol. xxxviii (1825), p. 265; Goldfuss, 'Petref. Germ.,' vol. ii (1833), p. 57, pl. xciii, fig. 7; ? Reuss, 'Verstein. böhm. Kreideformat.,' pt. 2 (1846), p. 30; Schröder, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xxxiv (1882), p. 265; Vogel, 'Verhandl. nat. Vereins d. preussisch. Rheinl.,' vol. xlix (1892), p. 59, and 'Hollandisch. Kreide' (1895), p. 24, pl. i, fig. 22.

figured as *P. elongatus* by d'Orbigny appears to belong to another species. *P. obliquus*, Sowerby, is probably identical with *P. elongatus;* the type, however, is missing, and the figures do not show the character of the ornamentation satisfactorily, but it is clear from the description that the ribs were in triplets and covered with numerous scales.

This is a moderately common species in the Upper Greensand and Lower Chalk. In a specimen from the Chalk Marl of Ventnor (Pl. XXXI, fig. 12) the shell is proportionately higher, and has a smaller apical angle than usual; it is near to the form figured by Geinitz (1872, pl. xliv, figs. 2, 3). Other specimens connect this high form with those of normal proportions. A few specimens from the Lower Greensand of Upware—now in the Woodwardian Museum, and in Mr. J. F. Walker's collection, were referred by W. Keeping to *P. Raulinianus;* their state of preservation is less satisfactory than that of Upper Cretaceous examples, but they approach closely some forms of *P. elongatus* from the Upper Greensand and Chalk, and are probably correctly referred to that species.

Types.—The type of *P. elongatus* came from the Cenomanian of Le Mans. The type of *P. obliquus* from the Upper Greensand (? Devizes) cannot be found in the Sowerby collection. The types of *P. Raulinianus* came from the Albian of Grand Pré and Machéroménil (Meuse).

Distribution.—Gault of Folkestone (zones viii and xi of Price). Cambridge Greensand. Upper Greensand of Ventnor. Malmstone of Alton. Chloritic Marl of Maiden Bradley. Rye Hill Sand of Warminster. Chalk Marl of Ventnor, Folkestone, and Burwell. Totternhoe Stone (*H. subglobosus* zone) of Arlesey and Burwell. Lower Greensand of Upware (see "Remarks" above).

PECTEN (CHLAMYS) CRETOSUS, *Defrance*, 1822. Plate XXXII, figs. 4 *a*—*d*, 5 *a*, *b*, 6 *a*—*c*; Plate XXXIII.

1822.	PECTEN CRETOSUS, *Defrance.*	*A. Brongniart.*	Descript. géol. Envir. de Paris (in *Cuvier's* Ossem. foss., vol. ii), pp. 251, 598, pl. iii, fig. 7.
—	— ARACHNOIDES, *Defrance.*	*Brongniart.*	Ibid., pp. 251, 599, pl. iii, fig. 8.
—	— NITIDA, *G. Mantell.*		Foss. S. Downs, p. 202, pl. xxvi, figs. 4, 9 (? fig. 1).
1823.	— NITIDUS, *J. de C. Sowerby.*		Min. Conch., vol. iv, p. 130, pl. ccexciv, fig. 1.
1825.	— CRETOSUS, *Defrance.*		Dict. Sci. nat., vol. xxxviii, p. 267.
—	— ARACHNOIDES, *Defrance.*		Ibid., p. 266.

1841. PECTEN NITIDUS, *F. A. Römer.* Die Verstein. nord-deutsch. Kreidegeb., p. 52.

1845. — UNDULATUS, *A. d'Orbigny.* In Murchison, de Verneuil, and de Keyserling's Géol. Russ. d'Europe, vol. ii, p. 490, pl. xliii, figs. 8—10.

1846. NITIDUS, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 28.

1847. — CRETOSUS, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 617, pl. cccexl, figs. 1—7.

1848. NITIDUS, *H. G. Bronn.* Index Palæont., vol. i, p. 927.

1850. CRETOSUS, *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 182.

A. d'Orbigny. Prodr. de Pal., vol. ii, p. 251.

NITIDUS, *A. d'Orbigny.* Ibid., p. 252.

— ZEISNERI, *A. Alth.* Geog.-pal. Beschreib. der nächst. Umgeb. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. ii), p. 249, pl. xii, fig. 36.

ARCUATUS, *Alth* (non *Sowerby*). Ibid., p. 245, pl. xii, fig. 29.

SUBINTERSTRIATUS, *F. Dixon* (non *d'Archiac*). Geol. Sussex, p. 356, pl. xxviii, fig. 19.

1854 — NITIDUS, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 176.

CRETOSUS, *Morris.* Ibid., p. 176.

1866 — *K. A. Zittel.* Die Biv. der Gosaugeb. (Denkschr. d. k. Akad. Wissensch. Math.-nat. Classe, vol. xxv), p. 112 (36 of reprint), pl. xviii, fig. 2.

1869. ZEISNERI, *E. Favre.* Moll. Foss. de Lemberg, p. 146, pl. xiii, fig. 2.

1870. CRETOSUS, *F. Römer.* Geol. Oberschles., p. 316, pl. xxxvii, fig. 6.

— *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 215, 218.

1871 — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.

— — NITIDUS, *Stoliczka.* Ibid., p. 428.

1872 CRETOSUS, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. ii), p. 34, pl. x, figs. 5, 6.

1882 — *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 265.

var. NITIDA, *Schröder.* Ibid., p. 266.

1887. — *A. Peron.* L'Hist. Terr. de Craie (Bull. Soc. Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii), p. 164.

1889. — *O. Griepenkerl.* Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 41 (not the synonymy).

— *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: IV, Die Teplitz. Schicht., p. 85.

1892 (CHLAMYS) CRETOSUS, *E. Stolley.* Die Kreide Schleswig-Holsteins (Mitth. Min. Inst. Kiel, vol. i), p. 239.

1897 CRETOSUS, *R. Leonhard.* Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 45.

? 1897. PECTEN CRETOSUS, var. NITIDA, *A. Hennig.* Revis. af Lamell. i Nilsson's 'Petrif. Suecana' (Kon. Fysiogr. Sällsk. i Lund. Handl., N. F., vol. viii), p. 49.

1898. — — *G. Müller.* Mollusk. d. Untersenon v. Braunschweig, etc. (Abhand. d. k. preussisch. geol. Landesanst., N. F., Heft 25), p. 31, pl. v, fig. 1.

1900. — — var. ZEISNERI, *C. Gagel and F. Kaunhowen.* Jahrb. d. k. preussisch. geol. Landesanst. u. Bergak. für 1899, p. 229.

— — — *A. Wollemann.* Die Fauna Senons von Biewende (ibid., 1900), p. 16.

1902. — — *J. P. J. Ravn.* Mollusk. i Danmarks Kridtafl. I. Lamellibr. (K. Danske Vid. Skrift. 6 Raekke, nat. math. Afd., vol. xi), p. 88, pl. i, figs. 11, 18.

— — — var. NITIDA, *Ravn.* Ibid., p. 88, pl. i, figs. 12, 13, 21.

Non 1833. — — *A. Goldfuss.* Petref. Germ., vol. ii, p. 58, pl. xciv, fig. 2 (= *crispus*, Römer, and *elongatus*, Lamarck).

Description.—Shell thin, ovate, higher than long, slightly inequilateral, rounded ventrally, antero-dorsal margin slightly concave, postero-dorsal margin straight or slightly convex. Valves of slight convexity. Apical angle varying from 90° to 105°. Ears moderately large, unequal.

Right valve flattened or slightly convex, with numerous narrow ribs which may be very slender or moderately strong; the interspaces are sometimes broader than the ribs, but narrower when the ribs are more numerous. In the interspaces are numerous regularly placed, linear, concentric ridges, which may be confined to the neighbourhood of the umbo, or may cover a larger part, or even the entire surface of the valve; these ridges are usually closer together ventrally than near the umbo. At some distance from the umbo, in a few or in many of the interspaces, new ribs appear, and sometimes remain throughout smaller than the primary ribs, but in other cases rapidly become of the same size as the primaries. Near the antero- and postero-dorsal edges of the valve the radial ribs are absent, and numerous fine striæ are placed nearly perpendicular to the edge. The ribs bear numerous spiny processes, which are usually scale-like and placed transversely, but may be more pointed or rounded and nodular; these processes may occur over the entire surface or be confined to parts, and they vary in size on different specimens. Anterior ear long, with a deep sinus; dorsal portion smooth, but between that and the sinus are from three to five spiny ribs, which are usually rather indistinct. Posterior ear smaller, triangular, with the outer angle slightly obtuse; with seven or eight radial ribs bearing scaly or nodular processes, and sometimes crossed by concentric ridges.

Left valve rather more convex than the right, and with similar ornamentation, but the ribs usually rather stronger, and sometimes more numerous; the concentric ridges are often less distinct, except near the umbo; ventrally, they are often placed very close together. Anterior ear with the outer edge convex, and eight to eleven radial ribs which are slightly spiny; the dorsal margin without ribs. Posterior ear smaller, with the outer angle obtuse, and with eight or nine ribs which are slightly spiny.

Measurements:

	M. cor-anguinum zone.				*Marsupites* zone.		*A. quadratus* zone.										*B. mucronata* zone.								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
Length	31	32	34	28	... 27	36	... 24	27	27·5	32	33·5	35	38	41	42	43	49	... 23	24	25	25	28	36	37	41 mm.
Height	38	37	38	33	... 28·5	42	... 28	32	33	36	39	40	42	47	48	48	55	... 27	28	30	31	33	42	44	48 ..

(1) *M. cor-anguinum* zone, Porton, Salisbury.
(2, 3) „ „ Gravesend.
(4) „ „ Northfleet.
(5, 6) *Marsupites* zone, Witherington, Salisbury.
(7—17) *A. quadratus* zone, East Harnham, Salisbury.
(18—25) *B. mucronata* zone, Norwich.

Remarks.—This species varies greatly in the details of its ornamentation, and to some extent also in the proportions of height and length. The number, closeness, and strength of the ribs differ considerably; near the ventral margin of the valves they may be of equal size, or alternately large and small, owing to the later ribs still remaining smaller than the earlier ones. When the ribs are relatively few in number the flat interspaces are broader than the ribs, as in the form named *P. arachnoides*, Defrance; when the ribs are more numerous the interspaces are narrower than the ribs. For a short distance ventrally to a strong growth-line the ribs are sometimes deflected to one side. The narrow concentric ridges are usually distinct near the umbo, and may be absent or indistinct on the rest of the shell, or they may extend to varying distances from the umbo, and in some cases cover the entire shell. Usually the concentric ridges are well-spaced near the umbo, and become closer together ventrally, but sometimes they are equally distant all over the shell, or even become more widely separated ventrally. Spines are usually present near the umbo, and may be absent from all the rest of the shell, or may recur at the ventral border only; often they extend to about one-third of the distance from the umbo, or even cover the entire surface. In some cases alternating spiny and smooth concentric bands occur, the change taking place at well-marked growth-lines, *e. g.* spines near the umbo, in the middle of the valve and at the ventral border, separated by two smooth bands. In other cases the spines may be absent from the greater part of the valve. The "spines" vary in form, being usually scaly, but sometimes more pointed or nodular; in some cases they are

rather irregularly developed, but in others they are placed at very regular intervals, and are of very uniform size. The differences in the spines are in some cases connected with the state of preservation of the specimens. Nothing less than a large series of micro-photographs would illustrate adequately all the differences in the ornamentation of this species.

A few large specimens (length 67 mm., height 72 mm), from the *B. mucronata* zone of Norwich, appear at first sight to differ greatly from this species, on account of the greater part of the valves being nearly smooth, or marked with linear radial grooves separating flat interspaces; these forms agree perfectly in outline and in the form of the ears with some of the large examples of *P. cretosus*, and I believe they are only large and much-worn examples of that species, since the characteristic ornamentation sometimes occurs in the neighbourhood of the umbo for a distance of about 10 mm. (Norwich Museum, No. 2189), or, in other cases, just below well-marked growth-lines near the ventral border of the valve, where the shell has undergone less wearing (Norwich Museum, No. 2188).

In this variable species the extremes differ to such an extent in their ornamentation that, when considered separately, they appear as distinct species, but on examining a large series of specimens[1] a complete gradation is found to exist between the different forms, which we must therefore regard as merely modifications of one species.[2] The different forms, moreover, are not confined to one horizon or one locality, and it seems therefore hardly necessary to give them distinct names; but from the same zone and the same spot (*e. g.* East Harnham and Norwich) extreme forms and connecting links may sometimes be found. Moreover, in some cases two types of ornamentation appear on different parts of the same shell. The form with numerous strong ribs agrees with the type of *P. cretosus*, Defrance. *P. arachnoides*, of the same author, is the variety with relatively few and narrow ribs, with the spines poorly developed, and with regularly-placed concentric ridges. A variety with very slender and numerous ribs (found at Trimingham, etc.) agrees with the example figured as *P. undulatus* by Holzapfel. Another form with numerous well-developed, regularly placed, spiny scales on the fairly numerous radial ribs approaches *P. serratus*.

It is very difficult to decide which of the two names, *cretosus* or *nitidus*, has the priority, since the exact dates of publication of the works of Cuvier and Mantell cannot be determined at present. Mantell's preface is dated May 1st, 1822, and the work was received by the Geological Society before the end of June of that year. Mr. C. D. Sherborn informs me that the work of Cuvier was noticed as

[1] I have had the opportunity of studying over 200 examples.

[2] Dr. Blackmore, who has made a very large collection of *P. cretosus*, has independently come to the same conclusion—that all are forms of one species.

published in the 'Bibliographie de la France' for June 8th, 1822, and he is inclined to think that it appeared somewhat earlier than Mantell's book.

Affinities.—*P. undulatus*, Nilsson,[1] and *P. serratus*,[2] Nilsson, are very closely allied to *P. cretosus*, but the examination of a large series of specimens could alone enable us to determine their exact relationships.

Types.—The types of *P. nitidus* (from Lewes and Brighton) cannot be found, but the specimen from Gravesend figured by Sowerby is in the British Museum. The types of *P. cretosus* and *P. arachnoides* came from the Upper Senonian of Meudon. I have not seen the types, but specimens from the same locality are in the Wiltshire Collection, and another has been sent to me by M. A. de Grossouvre.

Distribution.—*R. Cuvieri* zone of Dover. *T. gracilis* zone of the Dorset coast and Dover. *H. planus* zone of the Sussex coast and Dover. *M. cor-testudinarium* zone of the Sussex coast, Dover, Purley, and Hitchin. *M. cor-anguinum* zone of the Dorset coast, Winchester, Porton (Salisbury), the Sussex coast, St. Margaret's, Thanet, Northfleet, Purley, Haling Pit (South Croydon), Bromley. *Marsupites* zone of the Dorset coast, Winchester, Witherington, the Sussex coast, and Thanet. *A. quadratus* zone of the Dorset coast, Winchester, East Harnham (Salisbury), and the Sussex coast. *B. mucronata* zone of the Dorset coast, Clarendon and Alderbury (Salisbury), and Norwich. Chalk of Trimingham.

PECTEN (CHLAMYS) MANTELLIANUS, *d'Orbigny*, 1847. Plate XXXIV, figs. 1 *a*, *b*, 2, 3 *a*—*c*, 4—6.

1833.	PECTEN CONCENTRICUS, *S. Woodward.*		Geol. Norfolk, p. 48, pl. v, figs. 27, 28.
1847.	—	MANTELLIANUS, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 619, pl. cccxl, figs. 8—11.
1850.	—	— —	Prodr. de Pal., vol. ii, p. 251.
1854.	—	CONCENTRICUS, *J. Morris.*	Cat. Brit. Foss., ed. 2, p. 176.
1870.	—	MANTELLIANUS, *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 215.

[1] 'Petrif. Suecana' (1827), p. 21, pl. ix, fig. 10; Holzapfel, "Mollusk. Aachen. Kreide" ('Palæontographica,' vol. xxxv, 1889), p. 235, pl. xxvi, figs. 1, 2; Hennig, Revision af Lamell. i Nilsson's 'Petrif. Suecana' (1897), p. 48, pl. iii, figs. 9—11; Strombeck, 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xv (1863), p. 154; Schröder, ibid., vol. xxxiv (1882), p. 266.

[2] Op. cit. (1827), p. 20, pl. ix, fig. 9; Holzapfel, op. cit. (1889), p. 236, pl. xxvi, fig. 16; Hennig, op. cit. (1897), p. 50, pl. iii, fig. 15; Stolley, 'Die Kreide Schleswig-Holsteins' (1892), p. 238; Ravn, 'Mollusk. i Danmarks Kridtaft.' (1902), p. 89.

1871. Pecten Mantellianus (= concentricus), *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.

1879. — cf. concentricus, *C. Barrois.* Ann. Soc. géol. du Nord, vol. vi, p. 452, pl. xii, fig. 4.

1889. — Mantelli, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 235, pl. xxvi, fig. 6.

1892. — (Chlamys) Mantellianus, *E. Stolley.* Die Kreide Schleswig-Holsteins (Mittheil. Min. Inst. Kiel, vol. i), p. 237.

Non 1822. — concentricus, *T. Say.* Journ. Acad. Nat. Sci. Philadelphia, vol. ii, pt. 2, p. 259.

— 1825. — — *Defrance.* Dict. Sci. nat., vol. xxxviii, p. 253.

— 1837. — — *F. C. L. Koch and W. Dunker.* Beitr nord-deutsch. Oolithgeb., p. 43, pl. v, fig. 8.

Description.—Shell rather small, thin, ovate, dorsal third pointed; inequilateral, higher than long; postero-dorsal margin straight or slightly convex, and longer than the antero-dorsal, which is straight or slightly concave. Apical angle from 86° to 90°. Ears moderately large, rather high, unequal.

Right valve flat, with several (usually from three to five) strong growth-ridges separated by considerable intervals, and fine radial and concentric ornament, which is often indistinct or absent on the later parts of the valve. Radial ornament consists of about eleven very slightly elevated ridges or folds, which become indistinct ventrally; on the summits of the ridges there are usually two fine linear ribs, and others (two or three) of the same kind in the shallow furrows; near the anterior and posterior margins the radial ridges are replaced by ribs. Concentric ornament consists of fine, close-set, regular, linear ridges, which bear minute pointed granules where they cross the radial ribs. Anterior ear considerably larger than the posterior, and slightly produced dorsally, with a distinct, but not deep, sinus; surface with growth-lines, which become sinuous near the valve—above the sinuous part there are faintly marked radial ribs. Posterior ear with an outer angle of about 90°, and with well-marked growth-lines.

Left valve convex, with several strong growth-ridges at intervals. Ornamentation consists of seventeen or eighteen main ribs, which are narrow and but little raised; they are separated by broad, very shallow furrows. In the middle of each furrow is a similar but smaller rib, which, near the ventral border, sometimes becomes almost as large as the main rib. At some distance from the umbo other smaller linear ribs (two to five) are introduced. In some cases all the radial ribs become indistinct near the ventral border, where the shell is then smooth, except for concentric ornament. The concentric ornament consists of regularly-placed, fine, linear ribs, which are more widely spaced near the umbo than elsewhere, and form

a pointed granule where they cross the radial ribs; near the ventral border the ribs are often very closely placed. Ears triangular, with a few growth-lines; the anterior with granular ribs and nearly rectangular outer angle, the posterior smaller and with obtuse outer angle.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	39	38	33	32	30	28	26	20	mm.
Height	45	44	37	35	35	31	31	23	,,

(1—8) *B. mucronata* zone, near Norwich.

Affinities.—In form, and in the possession of similar radial and concentric ornamentation, this species resembles some of the varieties of *P. cretosus*, but is easily distinguishable by the stronger radial ridges, etc.

Remarks.—The differences in the appearance of the ornamentation in this species seem to depend mainly on the state of preservation; in some cases the right valve is almost smooth. Frequently in the larger specimens the later part of the valve is almost without ornament. By far the larger number of specimens which I have seen were obtained from the neighbourhood of Norwich, where it is a characteristic fossil.

Type.—The type of *P. concentricus*, Woodward, came from the Chalk of Norwich, but cannot now be found. The types of *P. Mantellianus*, d'Orbigny, came from the Senonian of Chavot (Marne).

Distribution.—*M. cor-anguinum* zone of South Croydon (Haling Pit). *B. mucronata* zone of Clarendon (near Salisbury), of Hartford Bridge and various other localities near Norwich. Upper Chalk of Sussex.

PECTEN (CHLAMYS) ROBINALDINUS, *d'Orbigny*, 1847. Plate XXXIV, figs. 7 *a,b*, 8 *a,b*, 9 *a,b*, 10 *a,b*, 11, 12 *a—c*; Plate XXXV, figs. 1—10.

1842. PECTEN INTERSTRIATUS, *A. Leymerie*. Mém. Soc. géol. de France, vol. v, p. 10, pl. xiii, fig. 1 (non *interstriatus*, Münster).

1845. — OBLIQUUS, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 249 (non *obliquus*, Sowerby).

1847. — ROBINALDINUS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 587, pl. cccexxxi, figs. 1—4.

? — — INTERSTRIATUS, *d'Orbigny*. Ibid., p. 594, pl. cccexxxiii, figs. 1—5.

1850. — APTIENSIS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 119.

1852. Pecten aptiensis, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 511, pl. xlvi, fig. 3.
1854. — interstriatus, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 176.
? 1861. — Robinaldinus, *P. de Loriol.* Anim. Invert. Foss. Mt. Salève, p. 101, pl. xii, figs. 9, 10.
? — — Barretti, *H. G. Seeley.* Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 118, pl. vi, fig. 1.
? 1869. — Robinaldinus, *P. de Loriol and V. Gilliéron.* Urgon. Inf. de Landeron (Mém. Soc. helvét. Sci. nat., vol. xxiii), p. 22.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 188, pl. clxx, figs 1—5.
1877. — aptiensis, *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxiii, p. 500.
? — — Barretti, *Jukes-Browne.* Ibid., p. 500.
? 1883. — Dutemplei, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 105.
1884. — Robinaldinus, *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palaeont. Abhandl., vol. ii), p. 53.
1895. — — *G. Maas.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 269.
1896. — — *A. Wollemann.* Ibid., vol. xlviii, p. 840.
— — Galliennei, Passyi, et subinterstriatus, *A. J. Jukes-Browne and W. Hill.* Quart. Journ. Geol. Soc., vol. lii, p. 150.
1900. — Robinaldinus, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 47.
? 1900. — cf. Robinaldinus, *G. Müller.* In W. Bornhardt, Zur Oberflachen u. Geol. Deutsch-Afrikas (Deutsch-Ost-Afrika, vol. vii), p. 551.

Description.—Shell ovoid, pointed dorsally, higher than long, slightly inequilateral, of moderate convexity. Apical angle from 80° to 85°. Ears rather large, unequal.

Right valve ornamented with numerous narrow, slightly raised ribs, which are sometimes wavy, and are separated by flattened spaces, often of greater width than the ribs. The ribs bear numerous small, scaly spines, which are placed transversely and are generally close together, but sometimes more widely and regularly separated. Spaces between the ribs covered by numerous striæ, which in the middle of the valve are more or less parallel with the ribs, but become more and more oblique in passing towards the anterior and posterior borders. Anterior ear large, with a large sinus, well-marked growth-lines, and faint radial ribs. Posterior ear

much smaller, triangular, outer angle obtuse, marked with radial striæ like those on the valve.

Left valve rather more convex, ornamented with similar but fewer ribs, bearing scaly spines which are often placed at fairly regular intervals. Interspaces with striæ as on the right valve. Ribs generally of nearly uniform size; but in some cases smaller ribs are intercalated at some distance from the umbo, so that alternating larger and smaller ribs are clearly seen. Narrow concentric ridges, placed at regular intervals, are sometimes present near the umbo. Anterior ear large, with a few radial ribs—usually near the valve only, leaving the upper part smooth; ribs crossed by oblique striæ. Posterior ear small, with outer angle obtuse, and marked with striæ.

Remarks.—This species varies greatly; the number of ribs on the left valve ranges from 35 to 57, and consequently the width of the interspaces also varies. Sometimes smaller ribs are intercalated between some of the others. The spines on the ribs may be close together and numerous, or fewer and more widely separated, and sometimes they have a fairly distinct concentric arrangement; in some cases the ribs on part of a valve, or on almost the entire surface, are without spines. Such smooth or nearly smooth forms occur in the Hythe Beds of Hythe, the Chloritic Marl of Maiden Bradley, the Rye Hill Sand of Warminster, the Cenomanian (Bed 12) of Beer Head, etc. The sharpness of the spines varies in different specimens, and is partly dependent on the nature of the enclosing rock. Some examples from Faringdon and also some from the Upper Greensand (Pl. XXXV, fig. 3) have ribs over the whole of the anterior left ear, and the ribs on the valve are numerous with the spines irregularly placed; I have not sufficient specimens to determine whether these are distinct from the other forms, or merely a variety. Some forms (Pl. XXXV, fig. 1) with few and strong ribs, and well-developed scales, also appear at first sight to be distinct, but it is difficult to draw a line between them and the normal form.[1] A much larger series of specimens is required to determine whether these forms are really distinct, or merely varieties.

Mr. Jukes-Browne now agrees with me in regarding the forms which he named

[1] A form similar to this, but having more numerous ribs and with the spines usually more pointed and erect, obtained from the Cenomanian Sandstone of Wilmington, etc. (Pl. XXXV, fig. 10) has been referred by Jukes-Browne to *P. hispidus*, Goldfuss. The state of preservation of the specimens is not sufficiently good to enable me to decide as to their affinities, but I am inclined to regard them as constituting only a variety of *P. Robinaldinus*. In some examples of the latter the spines are almost, if not quite, as large as in the former. They agree better with the figures of Geinitz than of Goldfuss, but the ribbing appears to vary considerably. Goldfuss, 'Petref. Germ.,' vol. ii (1833), p. 59, pl. xciv, fig. 4; Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' (1870), p. 215; Geinitz, 'Das Elbthalgeb. in Sachsen' ('Palæontographica,' vol. xx, pt. 1, 1872), p. 197, pl. xliv, figs. 9, 10; Jukes-Browne, 'Cret. Rocks of Britain,' vol. i (1900), p. 452.

(in 1897, see synonymy) *Galliennei*, *Passyi*, and *subinterstriatus* as identical with *P. Robinaldinus*.

The larger number of the specimens seen were obtained from the *Perna*-bed of Atherfield, the Rye Hill Sand of Warminster, the Chloritic Marl of Maiden Bradley, and the Cenomanian of the Devon coast.

Affinities.—This species is closely related to (and probably identical with) several forms described by d'Orbigny, d'Archiac, etc.

Pecten Passyi, d'Archiac,[1] from the Tourtia (Cenomanian) of Tournay, varies considerably, but is perhaps distinguished from *P. Robinaldinus* by the smaller intercalated ribs being more numerous and more distinct; in some cases (as in the type specimen) spines are absent from most of the ribs, but in other examples from Tournay, which I have seen, they are as numerous as in most specimens of *P. Robinaldinus*.

P. subinterstriatus, d'Archiac,[2] from the same horizon, appears to differ only in having very numerous ribs.

P. Dutemplei, d'Orbigny,[3] from the Gault, seems to be indistinguishable from *P. Robinaldinus*, except perhaps (as suggested by Pictet and Campiche) by the occurrence in *P. Dutemplei* of about fifteen ribs distributed over the whole surface of the anterior left ear, whereas (according to the same writers) in *P. Robinaldinus* seven or eight ribs only occur, and are confined to the lower part of the ear. But it is doubtful whether these characters are constant: in Leymerie's figure the ribs seem to be distributed over the whole ear; while in d'Orbigny's figure of *P. Robinaldinus* the ribs, although only six in number, are also distributed over the entire ear.

P. Galliennei, d'Orbigny,[4] is probably only a variety with rather fewer ribs on the valve, and with four or five ribs distributed over the anterior left ear. It is recorded by Pictet and Campiche from the Upper Greensand of Ventnor.

P. rhotomagenis, d'Orbigny,[5] from the Cenomanian of Rouen, is another similar form with numerous ribs.

P. Oosteri, de Loriol,[6] is likewise closely related to *P. Robinaldinus*.

The form figured by d'Orbigny as *P. interstriatus*, Leymerie, is probably only a variety, but it possesses fewer ribs than any English form which I have seen. It approaches, however, some examples found in the Upper Greensand.

The name *aptiensis* was proposed by d'Orbigny (1850) for the *interstriatus* of

[1] 'Mém. Soc. géol. de France,' ser. 2, vol. ii (1847), p. 309, pl. xv, fig. 9.

[2] Ibid., p. 311, pl. xv, fig. 10.

[3] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 596, pl. cccexxxiii, figs. 10—13.

[4] Ibid., p. 608, pl. cccexxxvi, figs. 5—8.

[5] Ibid., p. 609, pl. cccexxxvi, figs. 9—11.

[6] 'Anim. Invert. Foss. Mt. Salève' (1861), p. 102, pl. xiii, figs. 4—8; de Loriol and Gilliéron, 'Urgon. infér. de Landeron' (1869), p. 23, pl. i, fig. 18; F. J. Pictet and G. Campiche, 'Foss. Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 5, 1870), p. 192, pl. clxx, fig. 6.

Leymerie (*non* Münster); but *Robinaldinus*, which is one of the forms of this species with fewer and coarser ribs, has the priority. *P. aptiensis* is placed by Pictet and Campiche as a synonym of both *P. Robinaldinus* and *P. Dutemplei*.

Morris regarded *P. Dutemplei* and *P. Galliennei* as synonyms of *interstriatus*, Leymerie, and included in it both Upper and Lower Greensand forms.

P. Barretti, Seeley, from the Cambridge Greensand, is founded on a worn specimen, but is probably identical with *P. Robinaldinus*, unless the numerous ribs on the anterior left ear be regarded as a distinguishing character.

Types.—The type of *P. interstriatus*, Leymerie, came from Les Croûtes, Aube. D'Orbigny's specimens of *P. Robinaldinus* were obtained from the Neocomian of St. Sauveur, etc.

Distribution.—*Perna*-bed of Atherfield and East Shalford. Atherfield Beds of Sevenoaks. Hythe Beds of Hythe and Lympne. Lower Greensand of Faringdon, and perhaps Upware. Ferruginous Sands of Shanklin.

Chloritic Marl of Maiden Bradley. Upper Greensand of Ventnor. Rye Hill Sand of Warminster. Chalk Marl, zone of *A. Mantelli* (Meÿer's Beds 11 and 12) of Dunscombe, and Bed 11 of Beer Head.

PECTEN (CHLAMYS) STUTCHBURIANUS, *Sowerby*, 1836. Plate XXXV, fig. 11.

1836. PECTEN STUTCHBURIENSIS, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xviii, fig. 1.
— — STUTCHBURIANUS, *Sowerby*. Ibid., p. 360.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 177.

Description.—Shell large, ovate, higher than long, flattened, convexity small. Ornamented with numerous slightly-raised ribs, which on the greater part of the valve are alternately broad and very narrow, and are separated by narrow grooves; but towards the margin the alternation of ribs may be less distinctly marked, and the interspaces broader with indications of oblique striæ: the larger ribs have flattened or rounded summits, and are ornamented with transversely-placed scales. Umbones pointed; apical angle rather small (about 85°); ears high, not very distinctly separated from the rest of the valve.

Measurements (approximate):

	(1)	(2)	(3)	(4)
Length	90	79	50	58 mm.
Height	112	90	67	68 ..

(1—3) Haldon, (4) Blackdown.

Affinities.—No definite opinion can be given as to the affinities of this form.

since only imperfectly preserved specimens have been seen. The oblique striæ, and the scales on the ribs, however, seem to connect it with *P. Robinaldinus*, but it appears to be distinguished by the regular alternation of large and small ribs, and by its greater size. *P. Stutchburianus* presents some resemblance to one of the specimens from the Tourtia figured by d'Archiac[1] as *P. acuminatus*, Geinitz, but differs in the ribs being closer together and alternating in size.

Remarks.—The examples from Haldon differ from the type in having the scales on the ribs indistinct, but this difference is probably due to imperfect preservation.

Type.—Blackdown Greensand; in the Bristol Museum.

Distribution.—Greensand of Haldon and Blackdown.

Section Æquipecten, *P. Fischer*,[2] 1886.

('Manuel de Conch.,' p. 944.)

Pecten (Æquipecten) asper, *Lamarck*, 1819. Plate XXXV, fig. 12; Plate XXXVI, figs. 1 *a*,*b*, 2, 3, 4.

1770.			*M. Lister.* Conch., pl. ccccIxx, fig. 28.
1813.			Ostrea muricata, *J. Townsend.* The Character of Moses established for Veracity as a Historian, vol. i, pl. i, fig. 2.
1819.			Pecten asper, *Lamarck.* Anim. sans Vert., vol. vi, p. 180.
1820.			Pectinites asper, *E. T. v. Schlotheim.* Die Petrefactenkunde, p. 226.
1822.			Pecten asper, *J. de C. Sowerby.* Min. Conch., vol. iv, p. 95, pl. cccIxx, fig. 1.
—	—	—	*A. Brongniart.* Descr. géol. Envir. de Paris (in *Cuvier's* Oss. Foss., vol. ii), pp. 320, 603, pl. v, fig. 1.
1825.	—	—	*Defrance.* Dict. Sciences nat., vol. xxxviii, p. 261.
1832.	—	—	*G. P. Deshayes.* Encyc. Méth. Vers, vol. iii, p. 728.
1833.	—	—	*A. Goldfuss.* Petref. Germ., vol. ii, p. 58, pl. xciv, fig. 1.
1836.	—	—	*G. P. Deshayes and H. Milne Edwards.* Ed. 2 of Lamarck's Anim. sans Vert., vol. vii, p. 157.
1837.	—	—	*F. Dujardin.* Mém. Soc. géol. de France, ser. 2, vol. ii, p. 228.
? —	—	—	var. polonica, *G. G. Pusch.* Polens Palæont., p. 41, pl. v, fig. 7.
1839.	—	—	*H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 23.

[1] 'Mém. Soc. géol. de France,' ser. 2, vol. ii (1847), pl. xvi, fig. 3 (on the left-hand side, not the other fig. 3).

[2] I follow Dall in regarding *Æquipecten* as only a section of *Chlamys*. See 'Trans. Wagner Free Instit. Science of Philadelphia,' vol. iii (1898), p. 695.

1841. Pecten asper, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 53.
1846. — — *H. B. Geinitz.* Grundriss der Verstein., p. 469.
— — — *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 30, pl. xl, fig. 1.
1847. — — *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 599, pl. cccexxxiv, figs. 1—6.
1850. — — *H. B. Geinitz.* Das Quadersandst. oder Kreidegeb. in Deutschland, p. 184.
A. d'Orbigny. Prodr. de Pal., vol. ii, p. 168.
1852. — — *R. Kner.* Denkschr. d. k. Akad. d. Wissensch., Math.-nat. Cl., vol. iii, p. 317, pl. xvii, fig. 6.
1854. — — *J. Morris.* Cat. Brit. Foss., ed. 2, p. 175.
1855. — — *G. Cotteau.* Moll. Foss. de l'Yonne, p. 116.
1863. — — *A. Kunth.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 724.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 208, 213.
1871. — (Chlamys) asper, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.
1872. — asper, *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 198.
1876. — — *H. Deicke.* Die Tourtia von Mülheim a. d. Ruhr, p. 26.
1878. Chlamys asper, *E. Bayle.* Explic. de la Carte géol. de France, vol. iv, pt. 1 (Atlas), pl. cxxii, fig. 1.
1893. Pecten asper, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 234.

Non 1830. — — *Hart* (fide *d'Orbigny*).
— 1852. — — *L. Reeve.* Conch. Icon., vol. viii, pl. ii, fig. 10.

Description.—Shell usually rather large, nearly circular, equilateral, almost equivalve; antero- and postero-dorsal margins of equal length, straight or slightly concave. Valves moderately convex—right valve a little more convex than the left. Length equal to, or slightly greater than, height. Umbones sharp. Apical angle about 105°. Ears moderately large, unequal.

Surface of both valves ornamented with about seventeen main ribs, which are angular and elevated; near the anterior and posterior borders they are sometimes rather smaller than elsewhere; on the ribs are numerous sharp, hollow, ventrally directed spines. Near the umbo only these main ribs occur, but at a little distance from it another similar but smaller rib, with similar spines, is introduced on each side of the main rib; and later other ribs usually appear successively —often one or two, but sometimes three or more on each side of the main rib. These lateral ribs are not always of equal size, and not always placed at equal distances from one another. The antero- and postero-dorsal margins of the valves

are bent nearly perpendicularly to the plane between the valves, and this narrow, bent portion is ornamented with close-set grooves only, placed nearly perpendicularly to the line between the valves.

Ears ornamented with radial spiny ribs. Posterior ears triangular; anterior ears larger—the right with a well-marked sinus.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Length . .	76	71	67	67	65	62	60	57	55	49	mm.
Height . .	74	71	66	65	66	60	60	56	55	47	,,

(1) From the Cenomanian of Wilmington.
(2—10) From Warminster.

Affinities.—See *P. pexatus* (p. 190).

Remarks.—The number of lateral ribs varies to some extent, and in a few cases only one is found on each side of the main ribs throughout their length.

This species is abundant in the Upper Greensand of the south of England, especially at Warminster. It occurs less commonly in the Chloritic Marl, but is abundant in the Cenomanian of Devon.[1]

Type.—From the Cenomanian of Ferté Bernard (Sarthe). The specimen figured by Sowerby, from the Upper Greensand of Horningham near Frome, is in the British Museum.

Distribution.—Higher part of the Upper Greensand of Melcombe Bingham, Ballard Down, Ventnor, Savernake, Maiden Bradley, and Warminster. Rye Hill Sand of Maiden Bradley, Rye Hill, and Warminster. Chloritic Marl of Maiden Bradley and the Isle of Wight. Cenomanian (Meÿer's Beds 11 and 12) of the Devon coast and of Wilmington.

Pecten (Æquipecten) Beaveri, *Sowerby*, 1817. Plate XXXVIII.

1817.	Pecten Beaveri,	*J. Sowerby.*	Min. Conch., vol. ii, p. 131, pl. clviii.
1822.	—	— *G. Mantell.*	Foss. S. Downs, p. 127, pl. xxv, fig. 11.
1825.	—	— *Defrance.*	Dict. Sci. nat., vol. xxxviii, p. 264.
? 1833.	—	— *A. Goldfuss.*	Petref. Germ., vol. ii, p. 54, pl. xcii, fig. 5.
—	—	depressus, *Goldfuss.*	Ibid., p. 53, pl. xcii, fig. 4.
1837.	—	Beaveri, *H. G. Bronn.*	Lethæa Geog., p. 677, pl. xxx, fig. 19 (ed. 3, vol. ii, pt. 5, p. 273).

[1] *Pecten compositus*, Sowerby ('Trans. Geol. Soc.,' ser 2, vol. iv, 1836, p. 342, pl. xvii, fig. 20), from Blackdown, is probably a *Lima* related to *L. cenomanensis*, d'Orbigny. The type is in the Bristol Museum.

1841. Pecten Beaveri, *F. A. Römer.* Die Verstein. d. nord-deutsch. Kreidegeb., p. 54.
1850. — ? Beaveri, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 169.
— — jugosus, *J. de C. Sowerby*, in *F. Dixon.* Geol. Sussex, p. 347 (p. 382, ed. 2), pl. xxviii, fig. 26.
1854. — Beaveri, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 175.
1863. — — *A. v. Strombeck.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 108.
1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 214, 218.
1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.

Description.—Shell large, thin, oval or nearly circular; height usually slightly greater than length; margins evenly rounded except at the junction with the ears. Valves compressed, nearly equal, slightly inequilateral. Apical angle large, from 118° to 125°. Ears long, low, a little unequal.

Right valve with broad radial ribs, which have sharp and sometimes slightly irregular summits and gently sloping sides; there are also similar smaller ribs, which do not reach the umbo. The ribs are smaller anteriorly and posteriorly. The surface of the valve is ornamented with fine, close-set, concentric, linear ridges, and sometimes with radial ridges. Anterior ear with a well-marked sinus, ornamented with scaly ribs except near its junction with the valve. Posterior ear smaller, outer angle nearly a right angle; surface with ribs, sometimes obscured by concentric lamellæ.

Left valve with about seventeen main ribs, which are narrow, elevated, and sharp, sometimes slightly serrate at the summits; separated by broad furrows. A smaller rib is often introduced in the middle of the furrow at a distance from the umbo, and on the sides of the ribs other still smaller ribs may occur. Anteriorly and posteriorly the main ribs become smaller. The ribs and furrows are crossed by many fine, close-set, regular, concentric ridges, which are seen most distinctly in the furrows. Anterior ear a little more elevated than the posterior; both with radial ribs and sharp outer angles.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	81	86	88	106	96	109	mm.
Height	80	88	101	106	98	109	,,

(1, 2) Chalk Marl, Folkestone.
(3) ,, ,, Meldreth.
(4, 5) Totternhoe Stone, Burwell.
(6) *H. subglobosus* zone, Cherry Hinton.

Affinities.—*P. depressus*, Goldfuss, seems to be scarcely distinguishable from *P. Beaveri*. The specimen figured by Goldfuss as *P. Beaveri* does not show the

small ribs on the sides of the main ribs, and may perhaps be distinct, but this can be determined only by an examination of specimens.

Types.—The type was obtained from Lower Chalk of Childrey, near Wantage, and is said to be in the Oxford Museum. The type of *P. jugosus* is missing, and the locality from which it was obtained is not given by Sowerby. Mantell's figured specimen, from the Chalk Marl of Hamsey, also appears to have been lost.

Distribution.—Upper Gault (zone x) of Folkestone. Red Limestone of Hunstanton (*fide* Survey Memoirs). Chloritic Marl of Blackgang and Niton. Chalk Marl of Ventnor, Folkestone, Meldreth, Hunstanton, Stoke Ferry, etc. Totternhoe Stone of Cherry Hinton, Burwell, Dersingham, and Hunstanton. *H. subglobosus* zone of Blue Bell Hill (Burham), Shelford, and Cherry Hinton.

PECTEN (ÆQUIPECTEN) REXATUS, sp. nov. Plate XXXVI, figs. 5 *a*,*b*, 6, 7 *a*,*b*.

? 1850. PECTEN DUJARDINI, *J. de C. Sowerby*, in *F. Dixon*. Geol. Sussex, p. 356, pl. xxviii, fig. 4 (? locality).

1897. CHLAMYS TERNATA, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 382 (not the synonymy).

Description.—Shell small, ovate or nearly circular, pointed dorsally, equilateral, and almost equivalve; of slight convexity. Length usually a little less than height. Apical angle about 104°. Ears fairly large.

Both valves have radial folds, of slight elevation, and usually eleven in number. The entire surface is ornamented with numerous narrow, elevated, and sharply limited ribs, which are placed regularly, are of slightly unequal size, and bear many short, hollow spines, which are generally directed ventrally, but are sometimes nearly perpendicular. At the summit of each fold is a rib rather larger than the others, and bearing longer spines; other ribs occur on the sides of the folds, and are introduced at different distances from the umbo, the latest rib being the smallest. On each side of a fold, near the margin of the valve, there are generally three, but sometimes more ribs.

Ears slightly unequal, ornamented with four or more radial spiny ribs, and with a row of spines at the dorsal edge; byssal sinus moderately deep.

Measurements:

	(1)	(2)	(3)	(4)
Length	24	20	16·0	11·0 mm.
Height	25	20·5	16·75	11·5 „

(1, 3) *H. planus* zone, Cheveley.
(2) Upper Chalk, near Salisbury.
(4) *A. quadratus* zone, East Harnham.

Affinities.—This species resembles *P. asper* (see p. 186), but is much smaller, less convex, with fewer folds (or main ribs), and, in specimens of the same size, with more numerous and more closely placed ribs.

When describing the Mollusca of the Chalk Rock (1897), I referred this species to *P. ternatus*, Goldfuss, which was founded on a cast from the Quader Sandstone of Schandau (Saxony), and appears to be the form usually known as *P. Dujardini*. On further examination this determination did not seem altogether satisfactory, and I have recently, through the kindness of M. Raoul Fortin and M. A. de Grossouvre, received specimens of *P. Dujardini* from France; Professor Deichmüller has also sent me casts of Geinitz' figured specimens. I am now able to say that *P. Dujardini* differs from *P. pexatus* in having much stronger and more distinctly separated folds, with less distinct ribs and spines, and in having closely-placed concentric lamellæ; in specimens larger than those figured by d'Orbigny the ventral margins of the valves are sharply bent. Two of the specimens figured by Geinitz[1] (figs. 10, 11) may belong to *P. pexatus*, but they show the interior of the valves only. *P. Dujardini* appears to be more nearly related to *P. septemplicatus*, Nilsson, than to *P. pexatus*.

Distribution.—Zone of *T. gracilis* of Hooken (Devon). Zone of *H. planus* of Cheveley (Newmarket). Chalk Rock of Winchester and Clothall (Baldock). *Uintacrinus* zone of Devizes Road (Salisbury). Zone of *A. quadratus* of East Harnham. Zone of *B. mucronata* of Clarendon (Salisbury), and of Shute-end Pit, Alderbury.

PECTEN (ÆQUIPECTEN), sp. Plate XXXVI, figs. 8 *a*, *b*.

Description.—Shell small, flattened, ornamented with from ten to thirteen narrow, elevated ribs, which are separated by broad, flat interspaces. Ribs with hollow, curving spines, placed at regular and fairly distant intervals.

Remarks.—This form, of which I have seen three specimens only, appears to be distinguished from *P. asellus*, Sowerby,[2] by the spines on the ribs. It differs from *P. rarispinus*, Reuss,[3] in the absence of radial folds.

Distribution.—Chalk Rock of Winchester. *A. quadratus* zone of East Harnham (Salisbury) and near Winchester.

[1] 'Das Elbthalgeb. in Sachsen' (1872), pt. 2, pl. x, figs. 10, 11.

[2] J. de C. Sowerby, in F. Dixon, 'Geol. Sussex' (1850), p. 348 (p. 383, ed. 2), pl. xxviii, fig. 5. The locality and horizon of *P. asellus* are not given by Dixon, and the type cannot now be found. I have seen no example which could be referred to this species.

[3] 'Die Verstein. der böhm. Kreideformat.' (1846), pt. 2, p. 31, pl. xxxix, fig. 15; Geinitz, "Das Elbthalgeb. in Sachsen" ('Palæontographica,' 1872, vol. xx, pt. 2), p. 36, pl. x, fig. 13.

PECTEN (ÆQUIPECTEN) SARUMENSIS, sp. nov. Plate XXXVII, figs. 1, 2*a*,*b*, 3.

Description.—Shell small, slightly inequilateral, height and length nearly equal, outline rounded, convexity small. Apical angle 107° to 111°. Ears rather large.

Right valve ornamented with very numerous (fifty to sixty) narrow, well-marked, radial ribs, which are separated by deep, narrow grooves. The ribs are often slightly unequal, sometimes alternately, the smaller ribs being introduced later than the larger. The ribs bear numerous small, similar, spiny scales, placed either vertically or sloping, and sometimes having a roughly concentric arrangement; near the umbo concentric lamellæ occur. Postero-dorsal margin with fine oblique striæ. Anterior ear long, with a deep sinus and four radial ribs with spines. Posterior ear much shorter, with three or four radial, spiny ribs.

Left valve not seen.

Measurements:

	(1)	(2)	(3)	(4)	
Length	8·5	7·0	6	5·25	mm.
Height	8·0	6·75	6	5·0	„

(1—4) *A. quadratus* zone, East Harnham, Salisbury.

Affinities.—In form this species resembles *P. campaniensis*, but is easily distinguished by the much larger number of ribs. The ornamentation resembles that of *P. pexatus*, but the shell is without radial folds, the ribs are fewer, and the apical angle larger. Radial folds occur on even the smallest specimens of *P. pexatus*.

Types.—In Dr. Blackmore's collection.

Distribution.—*A. quadratus* zone of East Harnham (Salisbury). *B. mucronata* zone of Clarendon (Salisbury).

PECTEN (ÆQUIPECTEN) CAMPANIENSIS, *d'Orbigny*, 1847. Plate XXXVII, figs. 4—8.

1847.	PECTEN CAMPANIENSIS, *A. d'Orbigny.*	Pal. Franç. Terr. Crét., vol. iii, p. 620, pl. cccxl, figs. 12—16.
1850.	—	—	— Prodr. de Pal., vol. ii, p. 251.
1870.	—	—	*F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 215.
1887.	—	—	*A. Peron.* Hist. Terr. Craie S.E. du Bassin Anglo-Parisien (Bull. Soc. Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii), p. 163.
1889.	—	—	*O. Griepenkerl.* Senon von Königslutter (Palaeont. Abhandl., vol. iv), p. 44.

Description.—Shell small, nearly equilateral, nearly circular, length equal to, or slightly greater than the height. Antero- and postero-dorsal margins straightened. Convexity small. Apical angle about 106°. Ears moderately large, unequal.

Right valve with about twenty-four strong, rounded ribs at the margin, some of which may be formed by bifurcation at some distance from the umbo. The ribs may be all of nearly equal size, or those formed by bifurcation may be somewhat smaller and closer together. Grooves between the ribs are deep, but rather narrower than the ribs. Both grooves and ribs are crossed by concentric lamellar ridges, which are especially distinct near the umbo, and may be absent or indistinct ventrally; these ridges are continuous, and placed at regular intervals. Anterior ear long, with a deep sinus, and two or three serrate ribs radiating from its apex and crossed by fine concentric ridges. Posterior ear smaller, triangular, nearly smooth.

Left valve with similar ornamentation, but rather narrower ribs, some of which do not reach the neighbourhood of the umbo. Anterior ear rather long, with three or four well-marked radial ribs crossed by concentric ridges. Posterior ear smaller, with rather less distinct radial ribs and concentric ridges.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length	11·5	9·0	7	7	6	5·0	mm.
Height	11·0	8·75	7	6·75	6	4·75	,,

(1, 2) *B. mucronata* zone, Norwich.
(3, 6) ,, ,, Clarendon, Salisbury.
(4) *Uintacrinus* zone, Devizes Road, Salisbury.
(5) *A. quadratus* zone, East Harnham, Salisbury.

Affinities.—This species resembles both *P. acute-plicatus*, Alth,[1] and *P. leopoliensis*, Alth,[2] but is distinguished from both by its more numerous ribs, the narrower furrows, and concentric ridges.

Remarks.—This appears to be a rather rare species; I have seen only about a dozen specimens.

Type.—From the Senonian of Chavot (Marne).

Distribution.—*Uintacrinus* zone of Devizes Road, one mile west of Salisbury. *Marsupites* zone near Winchester. *A. quadratus* zone of East Harnham near Salisbury, and Winchester. *B. mucronata* zone of Clarendon near Salisbury, and of Norwich. Upper Chalk of Guildford. Chalk of Trimingham.

[1] Haidinger's 'Naturwiss. Abhand.,' vol. iii, pt. 2 (1850), p. 248, pl. xii, fig. 34; Favre, 'Moll. Foss. Craie de Lemberg' (1869), p. 148, pl. xiii, figs. 3, 4.

[2] Op. cit., p. 247, pl. xii, fig. 33; Favre, op. cit., p. 149, pl. xiii, fig. 5.

PECTEN (ÆQUIPECTEN) ARLESIENSIS, sp. nov. Plate XXXVII, figs. 9—11.

Description.—Shell small, nearly circular, pointed dorsally, height and length nearly equal; nearly equilateral; convexity moderate. Apical angle about 103°. Ears very unequal.

Right valve with fifteen or sixteen strong, rounded, radial ribs, which are undivided, and of nearly equal size, but somewhat smaller anteriorly and posteriorly. Ribs separated by strong, rounded grooves, a little narrower than the ribs. Fine, regularly-placed, concentric ridges cross both ribs and grooves, and are best marked near the umbo; on the ribs they develop into rather prominent, projecting scales. Near the posterior border of the valve the grooves are marked obliquely by closely set striæ. Anterior ear very long, with a deep sinus, and two or three radial ribs bearing scales or tubercles. Posterior ear much shorter, the outer angle approximately rectangular.

Left valve with similar ornamentation, but the ribs rather narrower and the scales somewhat more widely separated.

Measurements:

	(1)	(2)	(3)	(4)
Length	22	9·5	7	6 mm.
Height	23	9·5	7	6 „

(1, 3, 4) Totternhoe Stone, Arlesey.
(2) Chalk Marl, Folkestone.

Affinities.—This species resembles the form referred by Geinitz (from the Turonian), and by Fritsch, to *P. pulchellus*, Nilsson (see p. 196), but it differs in having fewer and more widely separated ribs. These characters, as well as the scales on the ribs, also separate *P. arlesiensis* from *P. campaniensis*, d'Orbigny.

Types.—From the Chalk Marl of Folkestone.

Distribution.—Chalk Marl of Folkestone, and from a deep boring in the axis of the Winchester anticline. Totternhoe Stone (*H. subglobosus* zone) of Arlesey.

PECTEN (ÆQUIPECTEN) PULCHELLUS, *Nilsson*, 1827. Plate XXXVII, figs. 12 *a*—*c*, 13, 14 *a*, *b*, 15.

1827. PECTEN PULCHELLUS, *S. Nilsson.* Petrific. Suecana, p. 22, pl. ix, fig. 12.
— — LINEATUS, *Nilsson.* Ibid., p. 22, pl. ix, fig. 13.
1833. — SPURIUS, *A. Goldfuss.* Petref. Germ., vol. ii, p. 51, pl. xci, fig. 10.
— — PULCHELLUS, *Goldfuss.* Ibid., p. 51, pl. xci, fig. 9.

1837. PECTEN PULCHELLUS, *W. Hisinger*. Lethæa Suecica, p. 51, pl. xvi, fig. 9.
— — LINEATUS, *Hisinger*. Ibid., p. 51, pl. xvii, fig. 1.
1841. — PULCHELLUS, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 52.
— — SPURIUS, *Römer*. Ibid., p. 52.
1842 — PULCHELLUS, *F. v. Hagenow*. Neues Jahrb. für Min., etc., p. 550.
1847 — — *J. Müller*. Petref. der Aachen. Kreidef., pt. 1, p. 33.
1848. — — *H. G. Bronn*. Index Palæont., vol. i, p. 929.
1850 — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 252.
— — SUBPULCHELLUS, *d'Orbigny*. Ibid., p. 252.
— — PULCHELLUS, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 184 (*partim*).
— — STASZYCI, *A. Alth*. Beschreib. der Umgebung von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii, pt. 2), p. 248, pl. xii, fig. 35.
1852 — — — *R. Kner*. Denkschr. d. k. Akad Wissensch. Math.-nat. Classe, vol. iii, p. 316, pl. xvii, fig. 2.
1863. — PULCHELLUS, *A. v. Strombeck*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 154.
1869. — — *E. Favre*. Moll. Foss. de la Craie de Lemberg, p. 145.
1870. — — — *C. Schlüter*. Neues Jahrb. für Min., etc., p. 951.
— — — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 219.
1871 — — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 428.
1889. — — — *E. Holzapfel*. Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 234, pl. xxvi, figs. 10—13.
— — — — *O. Griepenkerl*. Senon. von Königslutter (Palaeont. Abhandl., vol. iv), p. 45.
— — LINEATUS, *Griepenkerl*. Ibid., p. 44.
1892. — (CHLAMYS) PULCHELLUS, *E. Stolley*. Die Kreide Schleswig-Holsteins (Mittheil. Min. Institut. Univers. Kiel, vol. i), p. 240.
1895. — PULCHELLUS, *F. Vogel*. Holländisch. Kreide, p. 23.
— — SPURIUS, *Vogel*. Ibid., p. 22, pl. i, figs. 20, 21.
1897. — PULCHELLUS, *A. Hennig*. Revis. Lamell. i Nilsson's 'Petrif. Suecana' (Kon. Fysiogr. Sällsk. i Lund. Handl., N. F., vol. viii), p. 33, pl. ii, figs. 27, 29—32; pl. iii, figs. 1, 2.
1900. — (ÆQUIPECTEN) PULCHELLUS, *E. Philippi*. Zeitschr. d. deutsch. geol. Gesellsch., vol. lii, p. 101, fig. 18.
1902. — PULCHELLUS, *J. P. J. Ravn*. Mollusk. i Danmarks Kridtafl. I. Lamellibr. (Kgl. Danske Vid. Selsk. Skrift. 6 Række, nat. math. Afd., vol. xi), p. 82, pl. i, fig. 8.

Non 1842. Pecten pulchellus, *P. Matheron.* Cat. Foss. du Bouches-du-Rhône, p. 186, pl. xxx, figs. 4—6.
— 1853. — — *L. Reeve.* Conch. Iconica, vol. viii, pl. xxxii, fig. 142.
— 1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 33, pl. x, figs. 2—4.
— 1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Die Weissenberg. u. Malnitz. Schicht., p. 136, fig. 130.
— 1893. — — *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 243.

Description.—Shell small, oval, rounded, height equal to, or slightly greater than the length; nearly equilateral, the postero-dorsal margin a little longer than the antero-dorsal. Convexity of valves small. Apical angle about 103°. Ears of moderate size, unequal.

Right valve with a variable number (twenty-three to forty-four at the margin) of broad, flattened, radial ribs, separated by much narrower, shallow grooves; in approaching the umbo some of the ribs become united in pairs. Near the anterior and posterior borders ribs are small or absent. Both ribs and grooves are marked by numerous fine radial striæ, which, in the middle of the valve, are parallel with the ribs, but cut them more and more obliquely in passing toward the anterior and posterior margins, which they meet at acute angles. Anterior ear longer than high, with the outer margin rounded and a rather small sinus; posterior ear smaller, triangular, higher than long, outer angle obtuse; both ears with radial striæ like those on the valve, and the anterior ear sometimes with a few concentric ridges also.

Left valve with narrow, elevated, sharply-limited ribs, some of which (often alternate ones) do not reach the neighbourhood of the umbo. Ribs small or absent near the anterior and posterior margins. Grooves between the ribs broad and deep, marked by radial striæ like those on the right valve. Summits of ribs slightly serrate. Ears triangular, the posterior a little smaller than the anterior and with the outer angle obtuse; both ears with radial striæ.

Measurements:

	(1)	(2)	(3)	(4)
Length	20·5	15·0	12·5	10·5 mm.
Height	20·5	16·0	13·0	11·0 „

(1—4) from Trimingham.

Affinities.—*P. lineatus*, Nilsson, is a left valve of *P. pulchellus*. *P. spurius*, Goldfuss, from Haldem, of which the type is in the Munich Museum, has been shown by Hennig to be identical with *P. pulchellus*. The form from the Pläner-kalk of Strehlen referred by Geinitz to *P. pulchellus* is regarded by Schlüter,

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1903.

LONDON:

MDCCCCIII.

A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

UNIVERSITY LECTURER IN PALÆOZOOLOGY, CAMBRIDGE.

PART V.

PECTINIDÆ (*continued*). INTRODUCTION, BIBLIOGRAPHY, INDEX, AND TITLE-PAGE TO VOL. I.

PAGES 197—232, i—xliii; PLATES XXXIX—XLII.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1903.

PRINTED BY ADLARD AND SON, LONDON AND DORKING.

Holzapfel, Vogel, and Hennig as another species; it appears to differ in having scaly ribs, a larger anterior ear, and a larger apical angle. Goldfuss' *pulchellus* was thought by d'Orbigny to differ from Nilsson's species, and was named *subpulchellus* in the "Prodrome." *P. miscellus*, Goldfuss,[1] appears to be very near to *P. pulchellus*, and was regarded by d'Orbigny as identical with it. *P. subaratus*, Nilsson,[2] although similar in form, is easily distinguished by its more numerous ribs, etc.

Type.—Nilsson's specimens came from Köpinge, etc.

Distribution.—Chalk of Trimingham.

Sub-genus—NEITHEA, *Drouet*, 1824.

('Mém. Soc. Linn. de Paris,' vol. iii, p. 186.)

PECTEN (NEITHEA) ATAVUS, *Römer*, 1839. Plate XXXIX, figs. 1—5.

1839.	PECTEN ATAVUS, *F. A. Römer.*		Die Verstein. nord-deutsch. Oolithen-geb. Ein Nachtrag, p. 29, pl. xviii, fig. 21.
1841.	—	— —	Die Verstein. d. nord-deutsch. Kreidegeb., p. 54.
1847.	JANIRA ATAVA, *A. d'Orbigny.*		Pal. Franç. Terr. Crét., vol. iii, p. 627, pl. cccexlii, figs. 1—3, 5.
—	—	NEOCOMIENSIS, *d'Orbigny.*	Ibid., p. 629, pl. cccexlii, figs. 4, 6—9.
1850.	—	ATAVA, *d'Orbigny.*	Prodr. de Pal., vol. ii, p. 83.
—	—	NEOCOMIENSIS, *d'Orbigny.*	Ibid., p. 83.
1854.	PECTEN ATAVUS, *J. Morris.*		Cat. Brit. Foss., ed. 2, p. 175 (*partim*).
1855.	JANIRA ATAVA, *G. Cotteau.*		Moll. Foss. de l'Yonne, p. 117.
—	—	NEOCOMIENSIS, *Cotteau.*	Ibid,, p. 117.
? 1859.	—	ATAVA, *J. Vilanova y Piera.*	Mem. geogn.-agric. de Castellon, pl. iii, fig. 21.
1861.	—	— *P. de Loriol.*	Anim. Invert. Foss. Mt. Salève, p. 105, pl. xiv, fig. 1.
		NEOCOMIENSIS, *de Loriol.*	Ibid., p. 104, pl. xiv, figs. 2, 3.
1868.	—	ATAVA, *de Loriol.*	Valangien d'Arzier (Matér. Pal. Suisse, ser. 4), p. 48.
1870.	—	— *F. J. Pictet and G. Campiche.*	Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 237, pl. clxxx.
—	—	NEOCOMIENSIS, *Pictet and Campiche.*	Ibid., pp. 240, 251.
—	—	(NEITHEA) ORNITHOPUS, *W. Keeping.*	Foss., etc., Neoc. Upware and Brickhill, p. 107, pl. iv, fig. 5.

[1] 'Petref. Germ.,' vol. ii (1833), p. 51, pl. xci, fig. 8.

[2] 'Petrif. Suecana' (1827), p. 21, pl. ix, fig. 11; Hennig, 'Revision Lamell. i Nilsson's Petrif. Suecana' (1897), p. 46, pl. iii, figs. 14, 16, 17.

1884. Janira atava, *O. Weerth.* Die Fauna des Neocom. im Teutoburg. Walde (Palæont. Abhandl., vol. ii), p. 54.
1887. — — *L. Mallada.* Sinops. Espec. Fós. en España, vol. iii, Cret. infer. (Bolet. Com. Mapa geol. España, vol. xiv), p. 129.
— — neocomiensis, *Mallada.* Ibid., p. 130.
1891. — atava, *J. Felix.* Verstein. mexican. Jura- u. Kreide-Format. (Palæontographica, vol. xxxvii), p. 171.
1895. — — *G. Maas.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 269.
1896. — — *A. Wollemann.* Ibid., vol. xlviii, p. 841.
1899. Vola (Janira) atava, *D. J. Anthula.* Kreidefoss. d. Kaukasus (Beitr. z. Palæont. u. Geol. Österr.-Ungarns u. d. Orients, vol. xii), p. 71.
1900. Janira atava, *A. Wollemann.* Die Biv. u. Gastrop. d. deutsch. u. holländ. Neocoms (Abhandl. d. k. preussisch. geol. Land., N. F., pt. 31), p. 50.
? — Vola atava, *G. Müller.* Verstein. des Jura und der Kreide (Deutsch-Ost-Afrika, vol. vii), p. 551, pl. xxiv, fig. 4.

? Non 1883. Pecten (Neithea) atava, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 107, pl. iv, fig. 6.

Description.—Shell roughly triangular, often slightly inequilateral; ventral margin very convex, with deep incisions between the main ribs; postero-dorsal margin concave, antero-dorsal nearly straight. Anterior ears long, triangular.

Right valve convex, with the umbo considerably incurved and sharp. The six main ribs are prominent and rounded, and are separated by much broader interspaces, which are concave or somewhat flattened. In the interspaces and on the sides of the main ribs, from three to twelve small, slightly raised ribs usually occur, but are absent in some cases; the central ribs are rather stronger than the lateral. Numerous fine, equal, regularly placed, concentric ridges cross both ribs and interspaces; they are parallel with the ventral margin of the valve, and consequently bend ventrally in crossing the main ribs, and curve dorsally in the interspaces. Similar concentric ridges are also present on the ears.

Left valve flattened, sometimes slightly convex or slightly concave, with six main ribs, which are rounded and somewhat more prominent than those on the right valve. Interspaces broad and deep, with small ribs. Concentric ornamentation similar to that on the right valve.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Length	24	23	22	21	20	20	19	17	21	mm.
Height	30	28	29	25	26	25	25	22	27	,,

(1—8) Upware. (9) Faringdon.

Affinities.—Whilst recognising the close resemblance which exists between *P. atavus* and *P. neocomiensis*, Pictet and Campiche thought that the latter could be distinguished from the former by the absence of ribs in the interspaces. Wollemann, however, by means of a much larger series of specimens, has shown (1896) that the differences which were supposed to separate the two forms are not constant.

The form described by de Loriol[1] as *Janira Matheroniana* is very similar to *P. atavus*, and may prove to be identical with it.

Janira valangiensis, Pictet and Campiche,[2] differs from *Pecten atavus* chiefly in the convexity of the left valve.

Remarks.—The English examples of this species are of rather small size, the average height being about 26 mm.; none of them reaches the size of the large forms figured by d'Orbigny and by Pictet and Campiche. Many of our examples are more or less inequilateral, but even in the large specimens from Ste. Croix this character is sometimes noticeable. The anterior ear is also distinctly larger than the posterior in most specimens.

The large example from Upware, figured as *P.* (*N.*) *atava* by W. Keeping, is considerably worn, and the ribs in the interspaces are stronger than usual; consequently I am unable to regard it as belonging to *P. atavus*. It is probably only a worn specimen of *P.* (*N.*) *quinquecostatus*.

On account of their inequilateral character the specimens from Upware were regarded by W. Keeping as belonging to a distinct species, which he named *P. ornithopus;* but this form also occurs in Brunswick, and Wollemann has shown that it cannot be separated from *P. atavus*.

Types.—Römer's types came from the Hils-conglomerate of Schandelah and Schöppenstedt. Römer's figure is not quite satisfactory, but any doubt which may formerly have existed as to the nature of his species has been removed by Wollemann, who has obtained other specimens from the same locality. D'Orbigny's specimens of *P. neocomiensis* came from the Hauterivian near Neuchâtel, etc. The specimen figured by Keeping as *P. atavus* is in the collection of Mr. J. F. Walker. The types of *P. ornithopus* are in the Woodwardian Museum.

Distribution.—Lower Greensand of Upware and Faringdon. Ferruginous Sands of Shanklin.

[1] 'Foss. Corall. Valang. et Urgon. de Mt. Salève' (1866), p. 65, pl. E, fig. 9. Also in A. Favre, 'Rech. géol. dans Savoie,' vol. i (1867), p. 390, pl. C, fig. 27.

[2] 'Foss. Terr. Crét. Ste. Croix' (1870), p. 242, pl. clxxxi, figs. 1—3.

PECTEN (NEITHEA) COMETA (*d'Orbigny*), 1847. Plate XXXIX, figs. 6—10.

1847. JANIRA COMETA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 640, pl. cccexlv, figs. 15—20.
1850. — — — Prodr. de Pal., vol. ii, p. 170.
1868. — — *A. Briart and F. L. Cornet*. Descript. Mineralog. Géol. et Pal. de la Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 50, pl. iv, figs. 23, 24.
1870. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 252.

Description.—Shell small, subtriangular, much higher than long, nearly equilateral. Antero- and postero-dorsal margins long; ventral margin very convex, with deep incisions between the main ribs. Ears very unequal; the anterior very long, the posterior small.

Right valve very convex, with a greatly incurved umbo, and five[1] very prominent angular ribs, which are crossed by numerous fine concentric ridges. The main ribs are separated by broad, deep, rounded depressions in which from three to seven slightly raised radial ribs occur; these small ribs are flattened and separated by narrow grooves, and bear numerous fine ridges placed transversely. At distant intervals from two to four strong growth-ridges may occur.

Left valve flattened, with five strong, rounded radial ribs separated by broad interspaces, both being crossed by fine concentric ridges. A few strong growth-ridges may occur.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length	14	13·5	11	10	11 mm.
Height	18	19	14·5	13	16 ,,

(1, 2) Cenomanian, Wilmington.
(3, 4) Upper Greensand, Warminster.

Affinities.—This species is closely allied to *Janira longicauda*, d'Orbigny,[2] but is distinguished from it by the main ribs being narrower and more angular. It is also nearly related to *P. notabilis*, Goldfuss,[3] but differs in possessing five main ribs instead of six, and apparently also in being relatively higher.

[1] Occasionally a sixth rib, not quite so prominent as the others, occurs near the anterior margin.

[2] 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 639, pl. cccexlv, figs. 9—14. Geinitz, "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx, pt. 1, 1872), p. 202, pl. xlv, figs. 16, 17.

[3] 'Petref. Germ.,' vol. ii (1833), p. 56, pl. xciii, fig. 3. Geinitz, "Das Elbthalgeb. in Sachsen" ('Palæontographica,' vol. xx, pt. 1, 1872), p. 202, pl. xlv, figs. 10—12.

It is difficult to separate *Janira Johannis Bœhmi*, Tiessen,[1] from *P.* (*N.*) *cometa*, since in the latter the symmetry (depending on the position of the middle rib) varies in different specimens.

P. (*Neithea*) *cometa* also presents some resemblance to the smaller forms of *P.* (*N.*) *atavus*, but is distinguished by possessing five (instead of six) main ribs, by being relatively higher, and by having the right valve more convex.

Remarks.—This appears to be a relatively rare species. A specimen from the Cenomanian of Saint Jouin (Seine-Inférieure) has been sent me by M. Fortin, and agrees perfectly with the English examples.

Types.—D'Orbigny's specimens came from the Cenomanian of Villers (Calvados) and Le Havre (Seine-Inférieure).

Distribution.—Upper Greensand (zone of *Pecten asper*) of the Isle of Wight, Maiden Bradley, Melcombe Bingham (Dorset), south-west of Armswell Farm (Dorset), and west of Melbury Hill (Dorset). Rye Hill Sands of Warminster. Chloritic Marl of Ventnor and Maiden Bradley. Cenomanian of Wilmington.

PECTEN (NEITHEA) MORRISI (*Pictet and Renevier*), 1858. Plate XXXIX, figs. 11 *a*—*c*, 12 *a*, *b*, 13.

? 1841. PECTEN QUINQUECOSTATUS, var. *a*, *F. A. Römer*. Die Verstein. d. nord-deutsch. Kreidegeb., p. 54.

1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 249 (*partim*).

1846. — VERSICOSTATUS, *A. Leymerie*. Statist. géol. et min. du départ. de l'Aube, Atlas, p. 11, pl. vi, fig. 9.

1847. — QUINQUECOSTATUS, var., *J. Morris*. Quart. Journ. Geol. Soc., vol. iii, p. 295 (foot-note)

1853. JANIRA QUINQUECOSTATA, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 506, pl. xlv, figs. 3 *a*, *b* (not *c*).

1858. — MORRISI, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 128, pl. xix, fig. 2.

? 1859. — QUINQUECOSTATA, *J. Vilanova y Piera*. Mem. geogn.-agric. de Castellon, pl. iii, fig. 23.

1865. — MORRISI, *H. Coquand*. Mon. Aptien de l'Espagne, p. 151.

1870. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 244.

1887. — — *L. Mallada*. Sinops. Espec. Fós. España, vol. iii, Cret. infer. (Bolet. Com. Mapa geol. España, vol. xiv), p. 130.

[1] 'Zeitschr. d. deutsch. geol. Gesellsch.,' vol. xlvii (1895), p. 473, pl. xvii, fig. 5.

1901–2. Vola Morrisi, *P. Choffat.* Faune Crét. du Portugal, vol. i, ser. 4, p. 147, pl. iii, figs. 5, 6.

Non 1883. Pecten (Neithea) Morrisi, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 106 (= *quinquecostatus*).

Remarks.—The forms found in the lower part of the Lower Greensand are very closely related to *Pecten* (*Neithea*) *quinquecostatus*, but show, in general, certain small differences from the latter, so that it will, I think, be convenient to retain for them the name *Morrisi*, given by Pictet and Renevier.

As a rule *P.* (*N.*) *Morrisi* is characterised by the relatively greater height of the shell (and consequently smaller apical angle), by the smaller convexity of the right valve, the rather stronger main ribs, with the ribs of the interspaces rather more unequal in size, and lastly in having the areas,[1] as a rule, without ribs. The concentric ornamentation agrees with that of *P.* (*N.*) *quinquecostatus*.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	28	27	19	15	17	23	19	mm.
Height	34·5	34	23	19	19·5	28	25	,,

(1—4) *Perna*-bed, Atherfield.
(5, 6) Hythe Beds, Lympne.
(7) Crackers, Atherfield.

Distribution.—*Perna*-bed and Crackers of Atherfield. Hythe Beds of Lympne.

Pecten (Neithea) quinquecostatus, *Sowerby*, 1814. Plate XXXIX, figs. 14—17; Plate XL, figs. 1—5.

1814. Pecten quinquecostata, *J. Sowerby.* Min. Conch., vol. i, p. 122, pl. lvi, figs. 4—8.
1819. — versicostatus, *Lamarck.* Anim. sans Vert., vol. vi. p. 181.
1822. — quinquecostatus, *A. Brongniart.* Déscript. géol. envir. de Paris. In *Cuvier's* Ossem. Foss., ed. 2, vol. ii, pp. 251, 320, 332, 600, pl. iv, fig. 1.
— — quinquecostata, *G. Mantell.* Foss. S. Downs, pp. 128, 201, pl. xxvi, figs. 14, 19, 20.
1824. Neithea versicostata, *C. Drouet.* Mém. Soc. Linn. de Paris, vol. iii, p. 187, pl. vii, fig. 4.
1825. Pecten versicostatus, *Defrance.* Dict. Sci. nat., vol. xxxviii, p. 254.
1827. — quinquecostatus, *S. Nilsson.* Petrif. Suecana, p 19, pl. ix, fig. 8; pl. x, fig. 7.

[1] This term in this sub-genus refers to the parts of the right valve between the outermost main ribs and the antero- and postero-dorsal margins.

1832. PECTEN VERSICOSTATUS, *Bruguière*. Hist. nat. des Vers et des Mollusques (Encyc. méthod.), vol. iii, p. 727, pl. ccxiv, fig. 10.

1833. — QUINQUECOSTATUS, *A. Goldfuss*. Petref. Germ., vol. ii, p. 55, pl. xciii, fig. 1.

1834 — — *S. G. Morton*. Synops. Org. Remains Cret. U.S., p. 57, pl. xix, fig. 1.

1836 — VERSICOSTATUS, *Lamarck*. Anim. sans Vert. (ed. 2 by Deshayes and Milne-Edwards), vol. vii, p. 158.

— — QUINQUECOSTATUS, *S. G. Morton*. Amer. Journ. Sci., vol. xviii, p. 250, pl. iii, fig. 5.

1837 — VERSICOSTATUS, *F. Dujardin*. Mém. Soc. géol. France, vol. ii, p. 227.

— QUINQUECOSTATUS, *H. G. Bronn*. Lethæa Geogn., p. 678, pl. xxx, fig. 17.

— — *W. Hisinger*. Lethæa Suecica, p. 50, pl. xvi, fig. 2.

— — — *A. d'Archiac*. Mém. Soc. géol. de France, vol. ii, p. 186.

1839 — *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 22.

1841 — — var. *β*, *F. A. Römer*. Die Verstein. norddeutsch. Kreidegeb., p. 54.

1846. — — *E. Forbes*. Trans. Geol. Soc., ser. 2, vol. vii, p. 153.

— — — *H. B. Geinitz*. Grundr. der Verstein., p. 470.

- (NEITHEA) VERSICOSTATUS, *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 31 (*? partim*).

1847. JANIRA QUINQUECOSTATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 632, pl. cccexliv, figs. 1—5.

— PECTEN (NEITHEA) QUINQUECOSTATUS, *J. Müller*. Petref. Aachen. Kreideformat., pt. 1, p. 33.

JANIRA FONTANIERI, *A. d'Orbigny*. Voy. au Pole Sud dans l'Océanie sur les corvettes l'Astrolabe et la Zellée. Atlas, pl. vii, figs. 38—40.

1850 PECTEN QUINQUECOSTATUS, *J. de C. Sowerby*, in *F. Dixon*. Geol. Sussex, p. 356 (p. 386, ed. 2), pl. xxviii, figs. 1—3.

JANIRA QUINQUECOSTATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 169.

— FONTANIERI, *d'Orbigny*. Ibid., p. 253.

— PECTEN (NEITHEA) QUINQUECOSTATUS, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 186.

1851–2 NEITHEA QUINQUECOSTATA, *H. G. Bronn*. Lethæa Geogn., ed. 3, vol. ii, pt. 5, p. 275, pl. xxx, fig. 17.

1854 PECTEN QUINQUECOSTATUS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 177.

— — AEQUICOSTATUS, *Morris*. Ibid., p. 177 (*partim*).

1855. Pecten quinquecostatus, *W. H. Baily.* Quart. Journ. Geol. Soc., vol. xi, p. 462.
— Janira quinquecostata, *G. Cotteau.* Moll. Foss. de l'Yonne, p. 117.
1863. Pecten quinquecostatus, *A. Kunth.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 725.
1870. Janira quinquecostata, *F. Römer.* Geol. von Oberschles., p. 340.
— — — *C. Schlüter.* Neues Jahrb. für Min., etc., pp. 937, 951.
— — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 246.
1871. Vola quinquecostata, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 437, pl. xxxi, figs. 1—6; pl. xxxvii, figs. 4—9.
1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 201, pl. xlv, figs. 8, 9; pt. 2, p. 36, pl. x, figs. 17, 18.
1877. — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: II, Die Weissenberg. und Malnitz. Schicht., p. 137.
— Neithea quinquecostata, *W. M. Gabb.* Journ. Acad. Nat. Sci. Philad., ser. 2, vol. viii, pt. 3, p. 294.
1878. — — *E. Bayle.* Explic. Carte géol. France, vol. iv, Atlas, pt. i, pl. cxxii, figs. 2, 3.
1882. Vola quinquecostata, *H. Schröder.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxxiv, p. 271.
1883. Pecten (Neithea) Morrisi, *W. Keeping.* Foss., etc., Neoc. Upware and Brickhill, p. 106.
— — — atava, *Keeping.* Ibid., p. 107, pl. iv, fig. 6.
— Vola quinquecostata, *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: III, Die Iserschicht., p. 116, fig. 90.
1885. Janira quinquecostata, *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 21.
1889. Vola quinquecostata, *K. Martin.* Die Fauna der Kreideformat. v. Martapoera (Samml. Geol. Reichs-Museum in Leiden, vol. iv), p. 157, pl. xvi, figs. 10, 11.
— — — *A. Fritsch.* Stud. im Gebiete der böhm. Kreideformat.: IV, Die Teplitz. Schicht., p. 85.
— cf. quinquecostata, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 238.
1890. — — *M. Blanckenhorn.* Beitr. z. Geol. Syriens. Entwickel. d. Kreidesyst. in Mittel und Nord-Syrien, p. 77.
1890–91. Pecten quinquecostatus, *A. Peron.* Moll. Foss. Terr. Crét. de la Tunisie (Explor. Scient. de la Tunisie), pt. 2, p. 227.

1893. Janira (Vola) quinquecostata, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 237.
1895. — quinquecostata, *E. Tiessen.* Ibid., vol. xlvii, p. 471.
1896. Vola quinquecostata, *A. Rutot.* Bull. Soc. Belge de Géol., etc., vol. x, p. 30.
1897. — — *U. Söhle.* Geogn. Jahresh. (1896), p. 40.
— — — *R. Leonhard.* Kreideformat. in Oberschles. (Palæontographica, vol. xliv), p. 46.
— — — *A. Hennig.* Revis. af Lamellibr. i Nilsson's 'Petrif. Suecana Form. Cret.' (Kon. Fysiogr. Sällsk. i Lund. Handl., N. F., vol. viii), p. 52.
? 1900. — — *G. Müller.* Verstein. des Jura u. d. Kreide. (Deutsch-Ost-Afrika, vol. vii), p. 565, pl. xxiv, fig. 1.
1901. — — *H. Imkeller.* Die Kreidebild. Stallauer Eck u. Enzenauer Kopf (Palæontographica, vol. xlviii), p. 32.
1901–2. — — *P. Choffat.* Faune Crét. Portugal, vol. i, ser. 4, p. 148, pl. iii, fig. 7.
1902. — — *J. P. J. Ravn.* Mollusk. i Danmarks Kridtafl. I. Lamellibr. (D. Kgl. Danske vid. Selsk. Skrift. 6 Række, nat. og math., vol. xi), p. 95.

Non 1850. Pecten quinquecostatus, *R. Kner.* Verstein. Kreidemerg. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii), p. 29 (? = *striatocostatus*).

Description.—Shell ovate or somewhat triangular, nearly equilateral; height sometimes equal or nearly equal to, but usually rather greater than, the length.

Right valve moderately convex, with incurved umbo, and strong, rounded, regular ribs. Six main ribs are rather larger than the others, and project at the margin of the valve, forming angles between which the parts of the margin are slightly concave; the anterior and posterior main ribs are not quite so strong as the others. The interspaces between the main ribs are flattened or sometimes slightly concave; in the larger number of cases four ribs occur in each interspace, but occasionally there are three, five, or six ribs in one or more of the interspaces—not infrequently the interspace next the posterior area has five ribs. The two middle ribs of the interspaces are commonly rather stronger than one or both of the laterals; sometimes one lateral is very small. The grooves between the ribs are usually narrower than the ribs. Posterior area slightly larger than the anterior; both with ribs which are smaller than those on the rest of the shell; the anterior usually with from four to eight, the posterior with from five to eight ribs. Both ribs and grooves are crossed by numerous fine, regular, concentric

ridges, which run parallel with the margin of the shell and with the growth-ridges. Ears small or of moderate size, triangular, slightly unequal, with small radial ribs.

Left valve slightly concave or nearly flat; length greater than height. Ribs narrow, rounded, separated by broader grooves; six of the latter (corresponding in position with the main ribs of the right valve) are broader than the others. The ribs vary in number from twenty-seven to thirty-five, with also a few very small ribs near the anterior and posterior margins. Concentric ornamentation similar to that on the right valve. Ears triangular, nearly equal, with faint radial ribs.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Length .	23	30	21	15	11	35	17	32	22	17	19	17	48	33	30	26	22	23	21	20
Height .	27	34	26	19	13	35	19	35	26	20	22	19	52	37	35	30	26	27	24	22·5

	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)		(32)	(33)	(34)	(35)	(36)	(37)
Length . .	17	11	25	23	19	32	28	20	27	34	32	...	31	32	17	34	39	39 mm.
Height . .	20	14	28	26	22	33	33	20·5	30	35	35	...	29	28	16	30	37	33 mm.

(1—31) Right valves. (32—37) Left valves.

(1, 2) Lower Greensand, Upware.
(3—5) „ „ Faringdon.
(6—12) Upper Greensand (zone of *Pecten asper*): (6, 7) Shaftesbury; (8) Warminster; (9—11) Ventnor; (12) Haldon.
(13—22) Cenomanian, Wilmington.
(23—25) „ Devon Coast (Dunscombe and Branscombe).
(26) Upper Chalk (? *M. cor-anguinum* zone), Gravesend.
(27) „ „ Brighton.
(28) „ „ (? *M. cor-anguinum* zone), Gravesend.
(29) „ „ (*M. cor-anguinum* zone), Charlton.
(30) „ „ „ „ Gravesend.
(31) „ „ Lewes.
(32) Upper Greensand, Warminster.
(33) Upper Chalk (? *M. cor-anguinum* zone), Gravesend.
(34) Upper Greensand, Shaftesbury.
(35—37) Upper Chalk (*M. cor-anguinum* zone), Gravesend.

Affinities.—See *P.* (*N.*) *Morrisi* (p. 202), *quadricostatus* (p. 210), *æquicostatus* (p. 209), *sexcostatus* (p. 214).

The specimens from the Lower Greensand of Upware, which were referred by W. Keeping to *P.* (*N.*) *Morrisi* (see p. 201), agree perfectly in form, in the regularity of the ribs, and in the occurrence of ribs on the areas with *P.* (*N.*) *quinquecostatus* and should, I think, be referred to that species.

Remarks.—This species varies to some extent in the convexity of the right valve and in the relative proportions of length and height, but these variations seem to be connected with local conditions only. The specimens from the Upper

Greensand of Ventnor are rather more convex than usual; those from the Upper Greensand of Warminster are, as a rule, less convex and rather longer. Other modifications are seen in the strength of the main ribs, the flatness or slightly concave character of the interspaces, the number of ribs in the interspaces and the amount of their inequality, and the length of the hinge-line, which is correlated with the slope of the anterior and posterior areas.

In some specimens from the Upper Chalk (Plate XL, fig. 2) the main ribs are rather stronger than usual, the intermediate ribs more unequal, and the hinge-line shorter; but such forms can be matched with some of those found in the Cenomanian of Devon and France, whilst other Upper Chalk specimens belong to the type which is common in the Upper Greensand of Warminster and the Cenomanian of the Devon coast and France.

The specimens figured by Mantell were regarded by d'Orbigny as distinct from *Pecten quinquecostatus*, Sowerby, and were referred by him to *Janira Dutemplei*. Peron adopts the same view, and moreover refers the first two of Sowerby's figures (figs. 4, 5) to *P. Dutemplei*, and regards the Upper Greensand form as distinct. An examination of a number of specimens from the Upper Chalk shows, however, that whilst there is some variation, yet they are inseparable from the Upper Greensand form, and that they differ from *P. Dutemplei* (see p. 216). Morris also appears to have regarded the Warminster specimens as distinct from those found in the Chalk; the latter he referred to *P. quinquecostatus*, and the former to *P. æquicostatus;* but the Warminster form figured by Sowerby is certainly distinct from *P. æquicostatus*, Lamarck. A typical form of *P. quinquecostatus* from the Cenomanian of Rouen is figured by Bayle, and similiar specimens from that and other French localities have been sent me by M. Raoul Fortin of Rouen. In some Cenomanian specimens the main ribs are not so strong as usual; such forms make some approach to *P. æquicostatus*, but can be easily distinguished by their well-marked concentric ridges.

Types.—In the British Museum; figs. 4, 5, from the Chalk of Lewes; figs. 6—8 from the Rye Hill Sand of Chute Farm, Warminster. Mantell's figured specimens appear to have been lost.

Distribution.—Lower Greensand of Faringdon and Upware. Folkestone Beds of Folkestone.

Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown; malmstone of Devizes and the Isle of Wight. Upper Greensand (zone of *Pecten asper*) of Haldon, Cheddington (Dorset), Ball Wood (Dorset), Shaftesbury, Warminster, Ventnor, and Niton.

Rye Hill Sand of Warminster. Chloritic Marl of Maiden Bradley. Cenomanian (Meÿer's Beds 10 and 12) of Dunscombe and (Bed 11) of Branscombe and Whitecliff. Cenomanian Sandstone of Wilmington. *T. gracilis* zone of Dover

(*fide* Rowe). *H. planus* zone of Dover and the Sussex coast (*fide* Rowe). *M. cor-testudinarium* zone of Seaford, Chatham, and Purley. *M. cor-anguinum* zone of Mitcheldever (Hants), Broadstairs, Charlton, Northfleet, and Gravesend. *Marsupites* zone of Brighton and Margate. *A. quadratus* zone of Brighton, Paulsgrove (Hants), and West Harnham (Salisbury). Upper Chalk of Lewes.

PECTEN (NEITHEA) ÆQUICOSTATUS, *Lamarck*, 1819. Plate XL, figs. 8 *a*, *b*, 9 *a*—*c*.

1819. PECTEN ÆQUICOSTATUS, *Lamarck*. Anim. sans Vert., vol. vi, p. 181.
1824. NEITHEA PECTINOIDES, *C. Drouet*. Mém. Soc. Linn. de Paris, vol. iii, p. 186, pl. vii, figs. 1, 2.
1825. PECTEN ÆQUICOSTATUS, *Defrance*. Dict. Sci. nat., vol. xxxviii, p. 255.
1833. — — *A. Goldfuss*. Petref. Germ., vol. ii, p. 54, pl. xcii, fig. 6.
1836. — — *Lamarck*. Anim. sans Vert., ed. 2 (by Deshayes and Milne-Edwards), vol. vii, p. 158.
1839. — — *H. B. Geinitz*. Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 22.
1841. — — *F. A. Römer*. Verstein. nord-deutsch. Kreidegeb., p. 54.
1846. — — *H. B. Geinitz*. Grundr. der Verstein., p. 469.
— — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 32, pl. xxxix, fig. 22; pl. xl, figs. 2, 3.
? 1847. JANIRA ÆQUICOSTATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 637, pl. cccexlv, figs. 1—4.
1850. — ÆQUICOSTATA, *d'Orbigny*. Prodr. de Pal., vol. ii, p. 170.
— PECTEN ÆQUICOSTATUS, *H. B. Geinitz*. Das Quadersandst. oder Kreidegeb. in Deutschland, p. 186.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 175 (*partim*).
1863. — — *A. Kunth*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 725.
1868. JANIRA ÆQUICOSTATA, *A. Briart and F. L. Cornet*. Descript. Mineralog. Géol. et Pal. de la Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 49, pl. iv, figs. 25, 26.
1872. VOLA ÆQUICOSTATA, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 1), p. 200, pl. xlv, figs. 5—7.
? 1876. PECTEN ÆQUICOSTATUS, var. LONGICOLLIS, *H. Deicke*. Die Tourtia von Mülheim a. d. Ruhr. (Beitr. z. geogn. u. pal. Beschaffenh. d. unt. Ruhrgegend. Beitr. I), p. 26.

1878. Neithea æquicostata, *E. Bayle.* Explic. de la Carte géol. de France, vol. iv, pt. 1 (Atlas), pl. cxxii, fig. 4.

1882. Janira æquicostata, *P. de Loriol.* Gault de Cosne (Mém. Soc. Pal., Suisse, vol. ix), p. 102, pl. xiii, figs. 6–8.

1885. — — *F. Nötling.* Die Fauna d. baltisch. Cenoman. (Palæont. Abhandl., vol. ii), p. 21.

1893. — (Vola) æquicostata, *R. Michael.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlv, p. 237.

1894. Vola æquicostata, *A. Hennig.* Om Åhussandst. (Geol. Fören. i Stockholm Förhandl., vol. xvi), p. 520.

1895. Janira æquicostata, *E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 472.

1901–2. Vola æquicostata, *P. Choffat.* Faune Crét. Portugal, vol. i, ser. 4, p. 152, pl. iii, fig. 10.

? Non 1847. Pecten æquicostatus, *J. Müller.* Petref. Aachen. Kreideformat., pt. 1, p. 33.

Non 1850. — — *J. de C. Sowerby.* In *F. Dixon's* Geol. Sussex, p. 356, pl. xxviii, figs. 17, 18 (= *sexcostatus*).

Description.—Shell ovate, equilateral; ventral margin very convex and rounded; antero- and postero-dorsal margins slightly concave.

Right valve very convex, with a prominent incurved umbo, and with from thirty-four to fourty-four rather small, rounded ribs of nearly equal size, except those near the anterior and posterior margins, which are smaller. The ribs are separated by rounded furrows of about the same width as the ribs. Both ribs and furrows are smooth, or nearly smooth. Near the antero- and postero-dorsal margins are narrow, smooth areas without ribs, the anterior area being slightly smaller than the posterior. Ears of moderate size, triangular, nearly equal, smooth, or with fine concentric ridges.

Left valve flat or slightly concave, with ribs similar to those of the right valve.

Measurements:

	(1)	(2)	(3)
Length	14	10·5	9 mm.
Height	16	12	11 ,,

(1, 3) Upper Greensand (zone of *Pecten asper*), Haldon.
(2) ,, ,, ,, ,, ,, Worbarrow.

Affinities.—This species is distinguished from *P.* (*Neithea*) *quinquecostatus* by the ribs being of equal size, and smooth or nearly smooth; also by the ventral margin of the shell being evenly rounded and by the areas being without ribs. D'Orbigny's figure shows six more prominent ribs, but I have seen faint indications

of such ribs in only a few specimens. A typical form is figured by Bayle; it agrees perfectly with specimens from the Cenomanian of Rouen and Orbiquet which have been sent me by M. Fortin, and with others from the Cenomanian of Le Havre, sent by M. A. de Grossouvre.

Remarks.—Morris referred the specimens from the Upper Greensand, which Sowerby figured as *P. quinquecostatus* (figs. 6—8), to this species, but they are clearly distinguishable by the presence of six main ribs, and by the concentric ornamentation.

Types.—Lamarck's types came from the Cenomanian of Le Mans, and from near Angers. Goldfuss' specimens came from the Quader-sandstone near Dresden, and the Greensand of Regensburg.

Distribution.—Upper Greensand (Chert Beds, zone of *Pecten asper*) of Haldon, of Worbarrow, and Warminster. Chloritic Marl of Maiden Bradley.

PECTEN (NEITHEA) QUADRICOSTATUS, *Sowerby*, 1814. Plate XL, figs. 6, 7. Text-figs. 3—5.

1806. (Figure without name), *J. Sowerby.* British Mineralogy, vol. ii, p. 159, pl. clxxxiii.
1814. PECTEN QUADRICOSTATA, *Sowerby.* Min. Conch., vol. i, p. 122, pl. lvi, figs. 1, 2.
1833. — QUADRICOSTATUS, *A. Goldfuss.* Petref. Germ., vol. ii, p. 54 (*partim*), pl. xcii, fig. 7.
1837. — QUADRICOSTATA, *H. G. Bronn.* Lethæa Geogn, p. 680, pl. xxx, fig. 16.
1839. — QUADRICOSTATUS, *H. B. Geinitz.* Char. d. Schicht. u. Petref. des sächs. Kreidegeb., pt. 1, p. 22.
1841. — — *F. A. Römer.* Verstein. des nord-deutsch. Kreidegeb., p. 54.
1843. — — *H. B. Geinitz.* Die Verstein. von Kieslingswalda, p. 16, pl. iii, figs. 14, 15.
1846. — — *Geinitz.* Grundriss der Verstein., p. 469.
? — — VERSICOSTATUS, *A. E. Reuss.* Die Verstein. der böhm. Kreideformat., pt. 2, p. 31 (? *partim*).
1850. JANIRA GEINITZII, *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 197.
1850–51. NEITHEA QUADRICOSTATUS, *H. G. Bronn.* Lethæa Geogn., ed. 3, vol. ii, pt. 5, p. 277, pl. xxx, fig. 16.
1853. JANIRA FAUCIGNYANA, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 505, pl. xlv, fig. 2.
1854. PECTEN QUADRICOSTATUS, *J. Morris.* Cat. Brit. Foss., ed. 2, p. 177.
1863. — — *A. Kunth.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xv, p. 725.

1868. Janira quadricostata, *A. Briart and F. L. Cornet.* Descript. Mineralog. Géol. et Pal. de la Meule de Bracquegnies (Mém. cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 48, pl. iv, figs. 21, 22.

1870. — — *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 249, 251.

? — Pecten quadricostatus, *H. Credner.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxii, p. 232.

1871. Vola quadricostata, *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 430.

1872. — — *H. B. Geinitz.* Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx, pt. 2), p. 37, pl. x, figs. 14—16.

1874. Janira quadricostata, *W. Dames.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xxvi, p. 765.

? 1881. — — *J. Kiesow.* Schrift. nat. Gesellsch. in Danzig, N. F., vol. v, p. 414.

? 1882. — — — Ibid., vol. v, p. 240.

? — — — *P. de Loriol.* Gault de Cosne (Mém. Soc. Pal. Suisse, vol. xii), p. 103, pl. xiii, fig. 4.

1895. — — *E. Tiessen.* Zeitschr. d. deutsch. geol. Gesellsch., vol. xlvii, p. 472.

? 1897. Vola quadricostata, *U. Söhle.* Geogn. Jahresh. (1896), p. 39.

Non 1847. Pecten quadricostatus, *J. Müller.* Petref. Aachen. Kreideformat, pt. 1, p. 33.

— Janira quadricostata, *A. d'Orbigny.* Pal. Franç. Terr. Crét., vol. iii, p. 644, pl. cccexlvii, figs. 1—7 (= *Faujasi*, Pict. and Camp.).

— 1850. — — *A. Alth.* Geog.-pal. Beschreib. von Lemberg (Haidinger's Naturwiss. Abhandl., vol. iii), p. 249.

— — — *A. d'Orbigny.* Prodr. de Pal., vol. ii, p. 253.

— 1852. Pecten quadricostatus, *F. Römer.* Kreidebild. von Texas, p. 64, pl. viii, fig. 4.

? — — — — *R. Kner.* Kreideverstein. von Ost-Galizien (Denkschr. d. k. Akad. Wissensch. Math.-nat. Classe, vol. iii), p. 317.

? — 1854. — — *A. d'Archiac.* Bull. Soc. géol. de France, ser. 2, vol. xii, p. 215, pl. iii, fig. 10.

— 1866. Janira quadricostata, *K. A. Zittel.* Die Biv. der Gosaugeb. (Denkschr. d. k. Akad. Wissensch. Math.-nat. Classe, vol. xxv), pt. 2, p. 115, pl. xviii, fig. 4.

Non. 1869. Janira quadricostata, *E. Favre.* Moll. Foss. de la Craie de Lemberg, p. 155.
— 1876. Vola quadricostata, *D. Brauns.* Senon. des Salzberges (Zeitschr. f. d. gesammt. Naturwiss., vol. xlvi), p. 388.
— 1877. Janira quadricostata, *A. Peron.* Bull. Soc. géol. de France, ser. 3, vol. v, p. 502.
— 1889. Vola quadricostata, *E. Holzapfel.* Die Mollusk. Aachen. Kreide (Palæontographica, vol. xxxv), p. 237, pl. xxvi, fig. 20.
— — — — *O. Griepenkerl.* Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 48.
— 1892. Neithea quadricostata, *K. Futterer.* Kreidebild. des Lago di Santa Croce (Palæont. Abhandl., vol. vi), p. 80, pl. iii, fig. 6.
— 1894. Vola quadricostata, *A. Hennig.* Om Åhussandst. (Geol. Fören. i Stockholm Förhandl., vol. xvi), p. 520.
— — — — *B. Lundgren.* Mollusk-faunan i Mammillat. och Mucronata zonerna (K. Svenska Vet.-Akad. Handl., N. F., vol. xxvi, No. 6), p. 44.
— 1895. — — *F. Vogel.* Holländisch. Kreide, p. 25.
— 1896. — — *A. Rutot.* Bull. Soc. Belge de Géol., etc., vol. x, p. 30.
— 1901. — — *H. Imkeller.* Kreidebild. am Stallauer Eck, etc. (Palæontographica, vol. xlviii), p. 31, pl. i, figs. 8, 9,

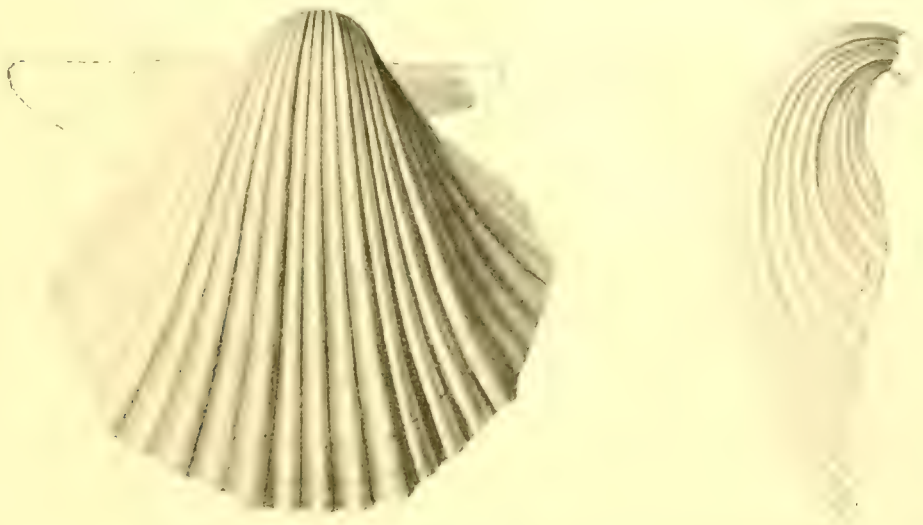
Description.—Shell large, ovate, rounded ventrally, more or less pointed dorsally, nearly equilateral; postero-dorsal a little longer than the antero-dorsal margin. Hinge-line long; ears large.

Right valve convex. Umbo prominent, incurved. Length of valve either equal to or slightly less than its height; greatest length at about the middle of the valve. Usually with twenty-one (occasionally twenty-four) ribs, which curve slightly outwards; all are strong and rounded, with slightly narrower furrows separating them. Six of the ribs are rather larger than the others, and project slightly at the ventral margin, forming angles, between which the margin of the valve is straight or slightly concave. The interspaces between the six main ribs are flattened, and in each, three (rarely four) smaller ribs occur; these are of nearly equal size, but the middle is sometimes slightly larger than the lateral. Occasionally this regularity in the ribs is partly lost owing to the stronger ribs being more numerous and the smaller ribs fewer than usual. Both ribs and furrows are crossed by numerous, very fine, regular concentric ridges, which are continued on to the areas. Antero- and postero-dorsal areas of fairly large size and sloping outwards—the former a little smaller than the latter. Antero-

dorsal area with four small radial ribs; postero-dorsal area with four or five (sometimes fewer) very small ribs. Ears very large and long, convex, with fine concentric ridges; the anterior with a sinus; the posterior larger than the anterior, with the outer angle acute, and usually with six faint radial ribs.

Left valve slightly concave or nearly flat, with a large apical angle; length greater than height, greatest length being above the middle line; usually with twenty-one rounded ribs of nearly equal size, separated by broader furrows, of which six—corresponding in position with the main ribs of the right valve—are

Fig. 3. Fig. 4.



Figs. 3 and 4.—*Pecten (Neithea) quadricostatus*, Sow. Upper Greensand, Warminster. Woodwardian Museum. Natural size. Fig. 3, right valve; Fig. 4, anterior view of the same.

rather broader than the others. Antero- and postero-dorsal areas with small ribs. Ears very large, elongate, triangular, with very small radial ribs.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
Length .	74	67	67	66	63	52	78	71	56	58	57	36	71	58	49	33	mm.
Height .	77	70	68	66	65	52	75	67	56	58	57	36	66	51	41	30	„

(1—12). Right valves:
- (1—6) Upper Greensand, Warminster.
- (7—9) Upper Greensand (zone of *P. asper*), Ventnor.
- (10—12) „ „ (zone of *Schlœnb. rostrata*), Blackdown.

(13—16). Left valves:
- (13—15) Upper Greensand (zone of *Schlœnb. rostrata*), Warminster.
- (16) „ „ (zone of *P. asper*), Ventnor.

Affinities.—This species resembles *P.* (*Neithea*) *quinquecostatus*, but is of larger size, with usually only three ribs in each interspace, and with relatively larger ears and longer hinge-line.

A form found in the Senonian was described and figured by d'Orbigny as

Janira quadricostata, and many later writers have followed d'Orbigny in referring that form to Sowerby's species; but it was shown by Pictet and Campiche, and also by Briart and Cornet, that d'Orbigny's species is distinct from Sowerby's. The latter differs from the former in being of larger size, in having much larger ears and a longer hinge-line, in the anterior and posterior areas sloping outwards, in the larger apical angle (seen especially in the left valve), and in the greatest length of the left valve being above the middle line. The Senonian form figured by d'Orbigny was named *Janira Fanjasi* by Pictet and Campiche,[1] and is regarded by Choffat[2] as identical with *regularis* of Schlotheim.

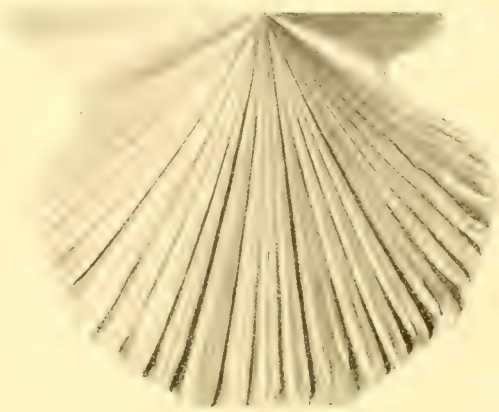


Fig. 5.—*Pecten (Neithea) quadricostatus*, Sow. Upper Greensand, Warminster. York Museum. Interior of left valve. Natural size.

Types.—The specimens figured by Sowerby are in the British Museum—fig. 1 is from the Upper Greensand of Haldon, fig. 2 from the Upper Greensand of Chute Farm, Warminster. The example figured in the 'British Mineralogy' is from the Upper Greensand of Stourhead.

Distribution.—Upper Greensand (zone of *Schlœnbachia rostrata*) of Blackdown and the Isle of Wight; Upper Greensand (zone of *Pecten asper*) of Haldon, Cerne Abbas, Melcombe Bingham, Eggardon Hill, Maiden Newton, Ballard Down (Swanage), Warminster, and Ventnor.

Pecten (Neithea) sexcostatus, *Woodward*, 1833. Plate XL, figs. 10—15; Plate XLI, figs. 1—10.

? 1822. Pecten quinquecostata ?, *G. Mantell.* Foss. S. Downs, p. 128, pl. xxv, fig. 10.
? — — triplicata, *Mantell.* Ibid., p. 128, pl. xxv, fig. 9.
1833. — sexcostatus, *S. Woodward.* Geol. Norfolk, p. 48, pl. v, fig. 29.

[1] "Foss. Terr. Crét. Ste. Croix" ('Matér. Pal. Suisse,' ser. 5, 1870), p. 253.
[2] 'Faune Crét. Portugal,' vol. i, ser. 4 (1901–2), p. 149.

1847. Janira Dutemplei, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 646, pl. cccexlvii, figs. 8—11.
1850. — — — Prodr. de Pal., vol. ii, p. 253.
— Pecten æquicostatus, *J. de C. Sowerby*, in *F. Dixon*. Geol. Sussex, p. 356 (p. 386, ed. 2), pl. xxviii, figs. 17, 18.
1854. — sexcostatus, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 177.
1870. Janira Dutemplei, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 253.
1877. — — *A. Peron*. Bull. Soc. géol. France, ser. 3, vol. v, p. 507, pl. vii, figs. 4, 4 *a*.
1887. Vola (Janira) Dutemplei, *Peron*. L'Hist. Terr. Craie (Bull. Soc. Sci. hist. et nat. de l'Yonne, ser. 3, vol. xii), p. 164.
1889. — Dutemplei, *O. Griepenkerl*. Senon. von Königslutter (Palæont. Abhandl., vol. iv), p. 48.
1891. — — *J. Böhm*. Die Kreidebild. des Fürbergs u. Sulzbergs (Palæontographica, vol. xxxviii), p. 83, pl. iii, fig. 33.
1896. — — ?, *A. Rutot*. Bull. Soc. Belge de Géol., etc., vol. x, p. 31, fig. 14.
? 1901–2. — cf. Dutemplei, *P. Choffat*. Faune Crét. Portugal, vol. i, ser. 4, p. 149, pl. iii, figs. 8, 9.

Description.—Form β (from the Upper Chalk, figs. 1—5). Shell ovately triangular, considerably higher than long, nearly equilateral. Ventral margin nearly semicircular, but with concave incisions of moderate depth between the main ribs. Both valves show well-marked growth-ridges at fairly distinct intervals. Hinge-line relatively short.

Right valve very convex, with six main ribs. Umbo greatly incurved and projecting beyond the level of the left valve. Antero- and postero-dorsal areas usually sloping inwards and concave. The six main ribs are usually prominent, and are separated by broad, concave, more or less deep interspaces. In the interspaces there are from four to seven [1] well-marked rounded ribs separated by furrows of about the same width; the central ribs are usually rather stronger than those at the sides (near the main ribs). The number of ribs in the interspaces varies in different specimens, and usually also in different interspaces of the same specimen; rarely four ribs are found in each interspace, less rarely five in each, but frequently five in four of the interspaces and six or seven in the remaining interspace, or the numbers in different interspaces may be four, five and six, or five, six and seven. The antero-dorsal area of this valve (*i. e.* the space between the anterior main rib and the anterior margin of the valve) bears from six to eight narrow ribs separated by broader furrows; these ribs are smaller than those in the interspaces

[1] Occasionally three or four very much smaller ribs are also present.

of the main ribs. On the postero-dorsal area from eight to twelve small ribs occur. Numerous fine, concentric, regular ridges are present on all the ribs; but the ridges in the furrows are less numerous and more widely separated than on the ribs, giving a ladder-like appearance. Ears nearly equal, triangular, of moderate size, with small radial ribs; the anterior ear more sharply marked off from the valve than the posterior ear.

Left valve flattened, sometimes slightly concave or slightly convex, with six main ribs which are less prominent than those on the right valve and are separated by shallow interspaces. At the summit of each main rib is a broad furrow. The ribs in the interspaces are narrow and separated by broader furrows; the number of ribs varies as on the right valve. Concentric ornamentation like that of the right valve. The antero- and postero-dorsal areas are narrow and bent at an angle with the rest of the valve; they bear small ribs. Ears nearly equal, with radial ribs.

Form *α* (from the Lower Chalk, figs. 6—10). The examples found in the Lower Chalk present some slight general differences from Form *β*. Thus (i) the margins between the main ribs are less concave, (ii) the growth-ridges are also less concave, (iii) the hinge-line is rather longer, and consequently the areas do not slope inwards, but, as a rule, slightly outwards, (iv) the convexity of the right valve seems, on the average, to be rather greater.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Length . .	16	14	13·5	6	21	20·5	19	18	17	16	15	15	15
Height . .	19	17	16	8	26	26	22	22	22	22	19	17·5	17

	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	
Length . .	13	10	16	15	13·5	13	12·5	10·5	8	15	14	11	mm.
Height . .	17	13	19·5	17	17	15	14	14	9	19	15·5	13	„

(1—15) Form *β*. (16—25) Form *α*.

(1—3) *B. mucronata* zone, Norwich.

(4) „ „ Clarendon, Salisbury.

(5—15) *A. quadratus* zone, East Harnham, Salisbury.

(16—22) Chalk Marl, Folkestone.

(23—25) Totternhoe Stone, Burwell.

Affinities.—This species is distinguished from *P.* (*Neithea*) *quinquecostatus* (see p. 202) by the following characters:—(1) the average size is much less; (2) on the right valve the main ribs are more prominent and the interspaces are more concave; (3) the ribs in the interspaces are less uniform in size; (4) the height of the shell is relatively greater; (5) generally the right valve is more convex and the umbo more sharply incurved; (6) the hinge-line is relatively shorter (especially in Form *β*); (7) the concentric ridges in the grooves are more

widely separated—in *P. quinquecostatus* these ridges are continued from the ribs across the grooves without change. See also *P. striato-costatus* (below).

Remarks.—The figure of *Pecten sexcostatus* given by Woodward is not sufficiently good for exact determination, but specimens which have been obtained from the same locality as the type leave no doubt as to the identity of *P. sexcostatus* with *Janira Dutemplei*, D'Orbigny.

The examples from the Lower Chalk are regarded by Peron as specifically inseparable from those found in the Upper Chalk, and with this view I agree, but since some slight differences are generally noticeable, I think it may be well to look on the examples from the Lower and Upper Chalk respectively as two forms or varieties of the same species, which may be referred to as Form *α* and Form *β*. A careful comparison of good series of specimens can scarcely leave any doubt on the mind as to the later forms having descended directly from the earlier. The examples found in the Gault probably also belong to Form *α*; they have, however, usually been referred to *P.* (*Neithea*) *quinquecostatus*.

The strength of the main ribs and the convexity of the right valve vary considerably in different specimens. There are also variations in the number of intermediate ribs, in their relative sizes, and in the depth of the incisions of the margin between the main ribs. In some examples from East Harnham the main ribs are unusually strong. In some of the larger specimens from Norwich the number of ribs near the margin of the valve is greater than usual owing to the introduction of small ribs in the grooves.

Types.—Woodward's type appears to have been lost. D'Orbigny's type of *Janira Dutemplei* came from the Senonian of Chavot (Marne).

Distribution.—Form α.—Chalk Marl of Dover, Folkestone, and Ventnor. Totternhoe Stone of Burwell. *H. subglobosus* zone of Cherry Hinton.

Form β.—*A. quadratus* zone of East Harnham (Salisbury) and Winchester. *B. mucronata* zone of Ballard Head (Dorset), Clarendon (Salisbury), and Norwich. Upper Chalk (? zone) of Brighton. Recorded by Rowe from the *M. cortestudinarium* and *M. cor-anguinum* zones of Thanet.

PECTEN (NEITHEA) STRIATOCOSTATUS, *Goldfuss*,[1] 1833. Plate XLI, figs. 9, 10.

A portion of a right valve and a nearly perfect left valve, which were found by

[1] 'Petref. Germ.,' vol. ii (1833), p. 55, pl. xciii, figs. 2 *c*, *d*, *e* (not 2 *a*, *b*, *f*, *g*); Favre, 'Moll. Foss. Craie de Lemberg' (1869), p. 156, pl. xiii, figs. 12, 13; Holzapfel, 'Moll. Aachen. Kreide' (1889), p. 239, pl. xxvi, fig. 19; Vogel, 'Holländisch. Kreide' (1895), p. 26; Müller, 'Mollusk. Untersen. v. Braunschweig u. Ilsede' (1898), p. 37; Ravn, 'Mollusk. i Danmarks Kridtaflej.' (1902), p. 95, pl. ii, figs. 8, 9; Wollemann, 'Fauna der Lüneburg. Kreide' (1902), p. 63.

Mr. Clement Reid in the Chalk of Trimingham, probably belong to *P.* (*Neithea*) *striatocostatus*, Goldfuss. The six main ribs of the right valve are less prominent than in *P.* (*N.*) *sexcostatus*, and both these and the ribs in the interspaces bear two or three small, almost linear ribs, so that the total number of ribs on the valve becomes considerable; fine concentric ridges, similar to those of *P.* (*N.*) *sexcostatus*, are found in the grooves and sometimes pass on to the ribs. On the left valve the ribs are in pairs.

P. striatocostatus is found in the Senonian of Denmark, Aachen, Lemberg, etc.

Genus—Velopecten, *Philippi*, 1898.

('Zeitschr. d. deutsch. geol. Gesellsch., vol. l, p. 597.)

Velopecten Studeri (*Pictet and Roux*), 1853. Plate XLI, fig. 11; Plate XLII, figs. 1—4.

1853. Hinnites Studeri, *F. J. Pictet and W. Roux.* Moll. Foss. Grès verts de Genève, p. 504, pl. xlv, fig. 1.

1866. — Salteri, *H. G. Seeley.* Ann. Mag. Nat. Hist., ser. 3, vol. xvii, p. 178.

1870. — Studeri, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), pp. 232, 234, pl. clxxix.

1875. — — *A. J. Jukes-Browne.* Quart. Journ. Geol. Soc., vol. xxxi, p. 296.

Description.—Shell large, oval or nearly circular, somewhat inequilateral and irregular; height a little greater than length. Hinge-line long, sometimes almost equal to the length of the shell. Ears very unequal; the anterior left ear not distinctly separated from the rest of the valve.

Right valve flat, sometimes slightly concave, with more or less undulating surface. Radial ribs much more numerous, smaller, and closer together than on the left valve, alternately larger and smaller. Numerous growth-ridges cross the ribs, and produce a serrate appearance. Byssal sinus very deep; anterior ear very large.

Left valve convex, with a more or less undulating surface, ornamented with about fifteen primary ribs, which are narrow, strong, and slightly wavy, and are separated by broad, shallow interspaces; these ribs are prominent on the dorsal part of the valve, but become smaller on the ventral part, especially in large specimens. A secondary rib is usually introduced in the middle of each interspace, at varying distances from the umbo; and between this and the primary ribs on each

side other ribs (sometimes four or five) are introduced; these are usually smaller, and may be quite close together, but in old specimens they become widely separated ventrally. Both ribs and furrows are crossed by numerous fine, close-set, regular, concentric ridges. Anterior ear with about seven primary and seven secondary ribs. Posterior ear smaller and more distinctly limited.

Affinities.—*Hinnites Salteri*, Seeley, from the Red Limestone of Hunstanton, is founded on a portion of the left valve; it appears to me to be only a large example of *V. Studeri*, in which the main ribs are less prominent than usual owing to the abrasion of the shell. See also *V. trilinearis* (below).

Remarks.—The state of preservation of the examples of this species varies considerably, but is usually rather unsatisfactory. In the specimens from Warminster, where the species appears to be rare, the shell is preserved, and the ornamentation is very well shown, but in those from Folkestone the shell has usually disappeared. The examples from the Cambridge Greensand are internal casts in phosphate, in which there is no trace of the ears, and whilst some of the principal ribs are shown the details of the ornamentation are wanting. The specimens from the Red Limestone of Hunstanton are usually considerably larger than those from the Cambridge Greensand, and have the shell preserved in part at any rate; in some cases the fine ornamentation is clearly shown, but often it is indistinct owing to the outer layers of the shell having disappeared; in these large forms the main ribs become much less strong near the ventral margin, or, in some cases, almost indistinguishable.

Types.—From the Gault of the Perte du Rhône. The type of *Hinnites Salteri*, Seeley, from the Red Limestone of Hunstanton, is in the Woodwardian Museum, Cambridge.

Distribution.—Upper Gault (zone x) of Folkestone. Cambridge Greensand (derived from the Upper Gault). Red Limestone of Hunstanton. Upper Greensand of Warminster.

VELOPECTEN TRILINEARIS (*Seeley*), 1861. Plate XLII, fig. 5.

1861. HINNITES TRILINEARIS, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 119, pl. vi, fig. 2.
1866. — — var., *Seeley*. Ibid., vol. xvii, p. 178.

Remarks.—The form named *Hinnites trilinearis* by Seeley was founded on a few imperfect specimens from the Cambridge Greensand. They seem to differ from the English examples of *V. Studeri* in having the primary ribs on the left valve stronger and more widely separated, but they approach very closely some of the specimens of that species figured by Pictet and Campiche, especially in having

small secondary ribs at the summits of the primary ribs. I have not sufficient material to enable me to decide whether or not *V. trilinearis* should be regarded as distinct from *V. Studeri*.

Type.—In the Woodwardian Museum.

Distribution.—Cambridge Greensand (derived from the Gault).

Velopecten pectinatus (*Seeley*), 1861. Plate XLII, fig. 6.

1861. Hinnites pectinatus, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 119.

Remarks.—This form agrees with *V. trilinearis* in having very strong primary ribs, but seems to differ in that those ribs are more numerous and consequently closer together; the secondary ribs at the summits of the primaries also appear to be better marked, and are crossed by distinct concentric ridges.

Type.—In the Woodwardian Museum.

Distribution.—Cambridge Greensand (derived from the Gault).

Velopecten, sp. Plate XLII, figs. 7, 8.

A few specimens from one of the nodule beds of the Gault of Folkestone agree with *V. trilinearis* (Seeley) in having relatively few main ribs on the left valve, and in the presence of secondary ribs at their summits, but the shell appears to be proportionately higher and shorter.

Genus—Hinnites, *Defrance*, 1821.

('Dict. Sci. nat.,' vol. xxi, p. 169.)

Hinnites Favrinus, *Pictet and Roux*, 1853. Text-figs. 6, 7.

1845. Hinnites Leymerii, *E. Forbes* (non *Deshayes*). Quart. Journ. Geol. Soc., vol. i, p. 250.

1853. — Favrinus, *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, pp. 503, 547, pl. xliii, fig. 2, pl. xliv.

1854. — Leymerii, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 169.

1858. — Favrinus, *F. J. Pictet and E. Renevier*. Foss. Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 135.

1865. — — *H. Coquand*. Mon. Aptien de l'Espagne, p. 155.

1870. Hinnites Favrinus, *F. J. Pictet and G. Campiche.* Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 5), p. 231, pl. clxxviii.

1871. — — *F. Stoliczka.* Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 430.

1887. — — *L. Mallada.* Sinops. Espec. Fóss. España, vol. iii, Cret. infer. (Bolet. Mapa geol. España, vol. xiv), p. 131.

Description.—Shell very large and thick, irregularly oval or subcircular, with rounded margins; height sometimes equal to, but usually rather greater than the length. Hinge-line rather long; ears nearly equal.

Right valve convex, attached by a more or less large portion in the region of

Fig. 6.—*Hinnites Favrinus*, Pict. and Roux. *Perna*-bed, Atherfield. Museum of the Geological Society, No. 2022. Right valve. × ⅓.

the umbo; the unattached part has numerous broad, rounded, radial ribs of unequal size and sometimes bifurcated. Ribs with scale-like projections, and sometimes showing fine radial grooves. A few concentric lamellæ or depressions, and also numerous fine growth-lines, cross both ribs and grooves.

Left valve nearly flat—sometimes slightly concave, sometimes slightly convex, with radial ribs and scales similar to those of the right valve, but the ribs rather

narrower and the intervening grooves broader. The scale-like projections are sometimes greatly developed.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	
Length .	139	130	130	118	118	113	mm.
Height .	152	135	131	123	122	120	,,

(1—6) *Perna*-bed, Atherfield.

Affinities.—This species is related to *Hinnites Renevieri* (Coquand),[1] but is distinguished by the ribs being less frequently bifurcated and more nearly straight. *H. Leymerii*, Deshayes,[2] differs from *H. Favrinus* by the great inequality of the ribs—a few being large with smaller ribs in the interspaces.

Philippi[3] has discussed the affinities of the group to which the above-mentioned

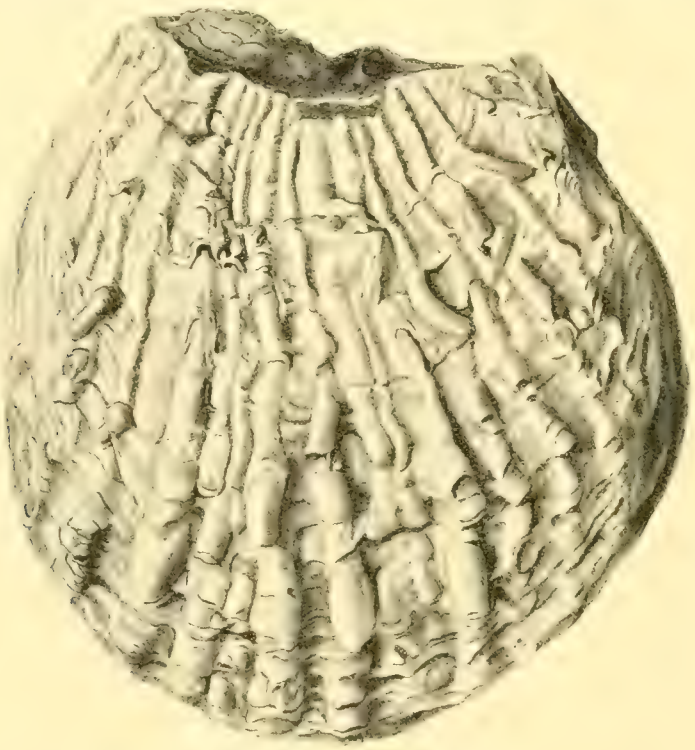


Fig. 7.—*Hinnites Favrinus*, Pict. and Roux. Museum of Practical Geology, No. 8444. Lower Greensand (*Perna*-bed), Atherfield. Left valve. × $\frac{2}{3}$.

species belong, and is inclined to regard it as genetically independent of the Tertiary species of *Hinnites*. This view seems to be based chiefly on negative evidence, viz. the absence, so far as at present known, of *Hinnites* from the Upper

[1] Pictet and Campiche, 'Foss. Terr. Crét. Ste. Croix' (1870), p. 227, pl. clxxvi.

[2] Pictet and Campiche, ibid., p. 224, pls. clxxiv, clxxv. Deshayes, 'Mém. Soc. géol. France,' vol. v (1842), p. 27, pl. xiv, fig. 1.

[3] 'Zeitschr. d. deutsch. Geol. Gesellsch.,' vol. l (1898), p. 601.

Cretaceous and early Tertiary deposits. But until definite evidence of the independent origin of the Tertiary species can be given it seems to me better to refer the Lower Cretaceous species to *Hinnites*, since they agree so closely with the typical species of that genus.

Types.—The specimen referred to *Hinnites Leymerii* by Forbes is in the Museum of the Geological Society (No. 2022). Pictet and Roux's types came from the Aptian of the Perte du Rhône.

Distribution.—*Perna*-bed and Fitton's Bed 13 of Atherfield. Hythe Beds of Court-at-Street, Hythe.

ADDITIONS AND CORRECTIONS.

Page 31. *Placunopsis undulata* (Müller). Two specimens closely resembling this species have been obtained by Mr. R. M. Brydone from the Trimingham Chalk. Figures are given by Holzapfel (1889) and Ravn (1902).

Page 35. *Barbatia aptiensis* (Pict. and Camp.). This species has been found by the Rev. W. R. Andrews at the base of the Gault at Dinton, in the Vale of Wardour, and recorded as *Arca Raulini* by Mr. Jukes-Browne.

Page 41. *Barbatia Galliennei* (d'Orb.). A specimen has been obtained from the Chloritic Marl of Maiden Bradley.

Page 70. Add PECTUNCULUS VAUGHANI, sp. nov. Plate XLII, fig. 11.

Description.—Shell stout, convex, nearly equilateral, but slightly longer anteriorly than posteriorly, with a rounded subquadrate outline; length a little greater than height. Umbones small. Hinge-area very small. Ornamentation consists of numerous flattened radial ribs, separated by linear grooves; the ribs are more numerous on the left valve than on the right, and more numerous on the anterior than on the middle parts of the valves. A few faintly marked growth-lines are seen at intervals. Interior of valves not seen.

Measurements :

Length	31·5 mm.
Height	30·0 ,,

Affinities.—This form presents some resemblance to *P. subconcentricus*, Lamarck,[1] but is more nearly equilateral, has a much smaller hinge-area, and the concentric ridges are absent.

Remarks.—I have seen only one specimen of this species. The two valves are united, and consequently the interior cannot be seen. The specimen was collected by Mr. Arthur Vaughan, B.A., B.Sc., and presented by him to the Woodwardian Museum.

Distribution.—Greensand of Blackdown.

Page 71, line 20 from the top. For "Bed ii" *read* "Bed 11."

Page 80. *Trigonia spectabilis.* Reference to Lycett—for pl. xxxvi *read* pl. xx.

[1] D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 189, pl. ccevi, figs. 12—19.

Page 96. *Modiola ligeriensis* (d'Orb.). The following should be added to the synonymy :—*Modiola striata*, Drouet, 'Mém. Soc. Linn. de Paris,' vol. iii (1824), p. 192, pl. vii, fig. 5. Non *Modiolus striatus* (Mont.), Maton and Rackett, 1807. Non *Modiola striata*, Defrance, 1824.

Page 106. *Septifer lineatus* (Sow.). A specimen from the *Belemnitella mucronata* zone, near Fareham (Hants), has been found by Mr. C. Griffith, of Winchester.

Page 106. "Family Dreissensiidæ, Gray," should be transferred to the middle of Page 110.

Page 111. Line 11 should follow line 5.

Page 112. Footnote 1. For vol. li *read* vol. xliii.

Page 135, line 3. For Kreide *read* Neocoms.

Page 143. For Plicatula sigillina *read* Dimyodon Nilssoni (*Hagenow*), 1842.

Additional synonymy.

1842.	Ostrea Nilssoni,	*F. v. Hagenow*	Neues Jahrb. für Min., etc., p. 546.
1891.	Dimyodon Nilssoni,	*J. Böhm.*	Die Kreidebildungen des Fürbergs, etc. (Palæontographica, vol. xxxviii), p. 89, pl. iv, fig. 7.
1892.	—	*E. Stolley.*	Die Kreide Schleswig-Holsteins (Mittheil. a. d. Min. Instit. Universit. Kiel, vol. i), p. 242.
1895.	Cyclostreon Nilssoni,	*F. Vogel.*	Holländ. Kreide, p. 14, pl. i, figs. 4—7.
1900.	Dimyodon Nilssoni,	*K. A. Grönwall.*	Meddel. Dansk. geol. Foren., No. 6, p. 75.
1902.	—	*J. P. J. Ravn.*	Mollusk. i Danmarks Kridtaflej. I, Lamellibr. (K. Danske Vidensk. Selsk. Skrift. 6. Række, nat. math. Afd., vol. xi), p. 109.

After the publication of Part III of this Monograph I received a copy of a paper by K. A. Grönwall on *Dimyodon* in the Danish Chalk. From the figures there given, and also from the one given by Böhm, I think that there can be no doubt as to the identity of *Plicatula sigillina* with the form described (but not figured) by von Hagenow as *Ostrea Nilssoni*. This identity has been confirmed by Mr. J. P. J. Ravn, of Copenhagen, to whom I have sent specimens of *Plicatula sigillina* from Norwich.

Ostrea Nilssoni has been referred by Böhm, Stolley, Grönwall, and Ravn to the genus *Dimyodon*, Munier-Chalmas.[1] When describing *Plicatula sigillina* I remarked that although it belonged to a type distinct from the other Cretaceous species, yet it resembled the recent form *Plicatula phillipinarum*, Hantz. I have not seen the adductor impressions in any specimens of *Plicatula sigillina*, but nevertheless I think that it is quite possible that the authors mentioned may be correct in referring this species to the genus *Dimyodon*, Munier-Chalmas.

Dimyodon costatus, Grönwall, seems to be very closely related to *D. Nilssoni*.

Page 152. *Pecten Nilssoni*, Goldf., Plate XLII, figs. 9, 10. Through the kindness of Mr. J. P. J. Ravn I have received specimens of *P. Nilssoni* from the Chalk of Faxe, and I am now able to state that I consider that the specimens from Trimingham, mentioned on page 152, and also another from the *Act. quadratus* zone of Hampshire (coll. R. M. Brydone), are referable to that species.

[1] In Fischer's 'Manuel de Conchyliol.' (1886), p. 957.

INDEX.

Synonyms are printed in *italics*. The Roman numerals refer to the plates on which the species are figured.

	PAGE
Acila	19
Æquipecten	186—197
Anomia	27—31
— convexa	29, v, 10
— lævigata	29, v, 6—9
— papyracea	31, v, 13—16
var *burwellensis*	31
— pseudoradiata	27, 30, v, 1—3
— *radiata*	27
— ? transversa	30, v, 12
Arca	32—35
aptiensis	36
— *Austeni*	37
— *carinata*	45
— Carteroni	33, vi, 4, 5
— *Cornueliana*	50
cymodoce	35
— Dupiniana	32, vi, 1—3
exaltata	49
— *fibrosa*	57
— *Fittoni*	52
— *Forbesi*	49
— *formosa*	56
— *Gabrielis*	49
— *Galliennei*	41
— *Geinitzi*	42
— *glabra*	57
— *Guerangeri*	64
— *Hugardiana*	40
isocardiæformis	65

	PAGE
Arca ligeriensis	47
Mailleana	63
marullensis	38
nana	62
obesa	61
Passyana	47
pholadiformis	35
radiata	42
Raulini	35
Robinaldina	52
rotundata	40
rotundita	40
Sanctæ-Crucis	34, vi, 6, 7
securis	44
subformosa	56
vendinensis	41
Barbatia	35—37
— aptiensis	35, 224, vi, 8, 9
— Austeni	37, vii, 1—3
— Galliennei	41, 224, vii, 9
Geinitzi	42, vii, 10, 11
— Hugardiana	40
— marullensis	38, vii, 4—7
— rotundata	40, vii, 8
— vendinensis	41
Brachydontes	101—103
— Guerangeri	101, xvii, 4, 5
Byssoarca marullensis	38

PAGE

Camptonectes ... ... 152—163
Cardium (Hemicardium ?) Austeni ... 37
— *umbonatum* 69
Ceromya crassicornis 65
Chlamys ... ... 163—186
— *ternata* 190
Crenella 104
— bella ... ... 104, xvii, 12, 13
Cucullæa ... ... 49—64
carinata 47, 57
— Cornueliana 50, viii, 11—13; x, 1—3
— (*Idonearca*) *Cornueliana* 51
— *costellata* 45
— (Dicranodonta) donningtonensis 54, x, 11—14; xi, 1, 2
— *errans* 52
— *fibrosa* 57
— Fittoni ... ... 52, x, 4—7
— Forbesi ... ... 49, ix
— *formosa* 56
— *Gabrielis* 49
— glabra ... 57, xi, 8—12; xii, 1—5
— Mailleana ... ... 63, xiii, 4, 5
— nana ... ... 62, xiii, 1—3
— obesa ... ... 61, xii, 6—8
(Dicranodonta ?) obliqua... 55, xi, 3, 4
— *Passyana* 47
— *securis* 44
— *striatella* 45
— *subnana* 50
— vagans ... ... 52, x, 8—10
— venusta ... ... 56, xi, 5—7
Cyclostreon Nilssoni 225
Cypricardia undulata 100

Dianchora lata 121
— *obliqua* 121
— *spinosa* 125
— *striata* 119
Dicranodonta 53
Dimyodon Nilssoni 225
Dreissensia 110
lanceolata 110, xviii, 13—15; xix, 1—11

Grammatodon ... ... 44—47

PAGE

Grammatodon carinatus ... 45, viii, 3—8
— securis ... 44, vii, 14—15; viii, 1, 2

Hinnites ... ... 220—223
— Favrinus ... ... 220, Text-figs 6, 7
— *Leymerii* 220
— pectinatus 220
— *Salteri* 218
— *Studeri* 218
— *trilinearis* 219

Idonearca fibrosa 57
— *glabra* 57
Inoceramus siliqua 99
Isoarca 65, 66
— Agassizi ... ... 65, xiii, 7
— *cantabrigiensis* 65
— obesa ... ... 65, xiii, 8
Isocardia crassicornis 65
— *Orbignyana* 65

Janira æquicostata 208, 209
— *atava* 197, 198
— *cometa* 200
— *Dutemplei* 207, 215, 217
— *Faucignyana* 210
— *Fontanieri* 203
— *Geinitzii* 210
— *Morrisi* 201
— *neocomiensis* 197, 198, 199
— *quadricostata* 211, 212
— *quinquecostata* ... 201—203, 205

Leda angulata 8
— *lineata* 7
— *Mariæ* 6
— *phaseolina* 9
— *scapha* 3, 7
— *Seeleyi* 5
— *siliqua* 11
— *solea* 5
— *spathulata* 1, 4
— *subrecurva* 2, 9
— *Vibrayeana* 10
Lima brightoniensis 128
— *spinosa* 128
Limopsis ... ... 71—73

PAGE

Limopsis albiensis 71, xv, 1, 2—4
Lithodomus ... 105
— rugosus? 105, xvii, 14
Lucina orbicularis 71
Lyriodon crenulatus 83
— *excentricus* 76
— *sinuatus* 76, 77
Lyrodon excentricum 76

Modiola ... ... 92—104
æqualis ... ... 92, xv, 8—14
angusta 106
— *bella* 104
Cornueliana 104
— *Cottæ* 106
— flagellifera ... ... 99, xvii, 1, 2
— *granulosa* 106
— (Brachydontes) Guerangeri, 101, xvii, 4, 5
— *lævigata* 94
— ligeriensis ... ... 96, 225, xvi, 4—6
— *lineata* 106
— *obesa* 93
— pedernalis 104
— *quadrata* 107
— reversa ... 94, xv, 15—18; xvi, 1—3
— rugosa 97
— *simplex* 97
— *striata* 225
— (Brachydontes) striato-costata, 103, xvii, 9—11
— *subfalcata* 111
— subsimplex ... ... 97, xvi, 7—10
— *typica* 96
— undulata ... ... 100, xvii, 3
(Brachydontes) vectiensis, 102, xvii, 6—8
Myoconcha ... 114
— cretacea ... ... 114, xx, 3
Mytilus ... 91, 92
— *abruptus* ... 110
— *æqualis* ... 92
— *asper* 106
— *bellus* 104
— *ciplyanus* ... 107
Cornulianus ... 104
— *Cottæ* 106
— *Cuvieri* ... 106
— *edentulus* 110

PAGE

Mytilus falcatus ... 110
flagellifera ... 99
Galliennei 111
Guerangeri 101
gurgitis ... 97
hainoensis 91
inæquivalvis ... 91, xv, 7
lanceolatus ... 110
ligeriensis ... 96
lineatus ... 106
Orbignyanus 107
peregrinus 107
prælongus 110
reversus 94
rugosus 97
semiradiatus 94
simplex ... 97, 114
spathulatus 107
striato-costatus 103
subangustus 106
— *subfalcatus* 110
— *sublineatus* ... 106
— *subrugosus* 97
— *subsimplex* 97
— tornacensis 91
— *tridens* 110
undulatus 101

Neithea (see Pecten) 197—218
Nucula ... ... 12—27
æquilateralis 2
albensis ... ... 24, iv, 9—17
antiquata ... 26, iv, 22—26
apiculata 23
(Acila) bivirgata ... ... 19, iii, 1—12
capsæformis 21
Cornueliana 13
Derancei 21
gaultina ... 25, iv, 18—21
impressa ... ... 23, iv, 5—8
impressa 12
Lamplughi ... 14, ii, 18, 19
lineata 7
Mori 6
Meÿeri ... 15, ii, 21
obesa ... 65
obtusa ... ... 22, iv, 2—4

PAGE

Nucula obtusa... 12
— *ornatissima* 19
- ovata, Mant. ... 21, iii, 16—21; iv, 1
- *ovata*, Phil. 12
— pectinata 16, ii, 22—27; iii, 13
— — *var.* cretæ ... 18, iii, 14, 15
- *phaseolina* 9
— planata .. ... 12, ii, 11—15
- *rhomboidea* 10
— *rhotomagensis* 65
— *scapha* 3
— *siliqua* 11
— *simplex* 14
— *solea* 5
— *spathulata* .. . 1
— *subelliptica* 10
— *subrecurva* 2, 9
- *Vibrayeana* . . . 10
Nuculana . .. . 1—11
— *angulata* . . .. .. 8, i, 33—35
- lineata . .. .. 7, i, 28—32
— Mariæ .. .. 6, i, 25—27
— phaseolina ... . 9, ii, 1—3
- (? Yoldia) scapha . . .. 3, i, 8—14
— Seeleyi .. . ... 5, i, 15—17
siliqua ... ... 11, ii, 10
solea ... . 5, i, 18—24
spathulata ... . 1, i, 1—3
speetonensis ... ... 3, i, 6, 7
— subrecurva... .. ... 2, i, 4, 5
- Vibrayeana ... ... 10, ii, 4—9

Ostrea muricata . . . 186
— *Nilssoni* 225

Pachytos spinosus 127
- *striatus* 127
Pecten ... ... 145—218
— (Neithea) æquicostatus ... 208, xl, 8, 9
- *æquicostatus* ... 203, 215
var. *longicollis* 208
(*Chlamys*) *aptiensis* 181, 182
arachnoides 174, 177, 178
— (*Camptonectes*) *arcuatus* 159, 160, 161
- (*Chlamys*) *arcuatus* 175
— (Æquipecten) arlesiensis, 194, xxxvii, 9—11
· (*Camptonectes*) *arzierensis* . 158

PAGE

Pecten (Æquipecten) asellus ... 119
asper
186, xxxv, 12; xxxvi, 1—4
— (Neithea) atavus ... 197, xxxix, 1—5
(*Chlamys*) *Barretti* 182, 185
— (Æquipecten) Beaveri ... 188, xxxviii
— (Chlamys) britannicus 167, xxxi, 1, 2
— — *Brongniarti* 169
— (Æquipecten) campaniensis
192, xxxvii, 4—8
– (Camptonectes) cinctus ... 152, xxviii
- (*Syncyclonema*) *circularis*, Gein. ... 146
– (*Camptonectes*) *circularis* ... 154, 156
— (*Chlamys*) *comans* 171, 172
- (Neithea) cometa ... 200, xxxix, 6—10
– (*Chlamys*) *concentricus* ...179, 180, 181
— (Camptonectes) Cottaldinus, 156, xxix, 1—3
— (*Syncyclonema*) *Cottaldinus* . . . 147
- (*Camptonectes*) *crassitesta* ... 153, 154
– (Chlamys) cretosus, 174, xxxii, 4—6; xxxiii
— — *cretosus*, Goldf. 171
– — — var. *nitida* ... 176
— var. *Zeisneri* ... 176
— *crispus* 171, 176
· (Camptonectes) curvatus
159, xxix, 7; xxxvii, 16
(*Æquipecten*) *depressus* ... 188, 189
– (*Camptonectes*) *divaricatus* 160
— — dubrisiensis ... 162, xxix, 8
(*Æquipecten*) *Dujardini* ... 190, 191
- (*Chlamys*) *Dutemplei* 182
— elongatus
170, xxxi, 10—13; xxxii, 1—3
- *Faujasi* 171, 173
— fissicosta ... 163, xxx, 3—8
· — *Galliennei* 182, 184
— (Camptonectes ?) gaultinus 163, xxx, 1, 2
— (*Syncyclonema*) *germanicus* ... 147, 148
— (*Chlamys*) *hispidus* ... 183 (foot-note)
(*Camptonectes*) *imperialis* 153
(*Chlamys*) *interstriatus* ... 181, 182
(*Æquipecten*) *jugosus* ... 189, 190
· (*Syncyclonema*) *laminosus* 145, 146, 149
· (*Camptonectes*) *lens*, var. *Morini* ... 158
(*Æquipecten*) *lineatus* ... 194, 195
· (*Chlamys*) *Mantelli* 180
Mantellianus 179, xxxiv, 1—6

PAGE

Pecten (Chlamys) Marrotianus 171, 173
Milleri ... 168, xxxi, 3–6
(Camptonectes) Morini 159
(Neithea) Morrisi ... 201, xxxix, 11–13
Morrisi 204, 206
Nilssoni ... 149, 152, 226, xlii, 9, 10
(*Chlamys*) *nitidus* 174, 178
obliquus ... 170, 171, 181
(*Syncyclonema*) *opercularis* 146
orbicularis ... 145, xxvii
var. *Lohmanni* 147
(*Syncyclonema*) *orbicularis*, var. *magnus* 147, 148
(*Neithea*) *ornithopus* 197, 199
(*Chlamys*) *Passyi* 182, 184
(Æquipecten) pexatus 190, xxxvi, 5—7
pulchellus 194, xxxvii, 12–15
(Chlamys) Puzosianus 165, xxx, 9–12
(Neithea) quadricostatus 210, xl, 6, 7
quinquecostatus 202, xxxix, 14–17; xl, 1—5
— *quinquecostatus* ... 201, 214
(*Chlamys*) *Raulinianus* 171, 173
Robinaldinus 181, xxxiv, 7–12; xxxv, 1–10
(*Camptonectes*) *Rœmeri* 153
(Æquipecten) sarumensis 192, xxxvii, 1—3
(Neithea) sexcostatus 214, xl, 10–15; xli, 1—10
(*Æquipecten*) *spurius* 194, 195
— *Staszyci* ... 195
(Neithea) striato-costatus? 217, xli, 9, 10
(Camptonectes) striato-punctatus 157, xxix, 4–6
striato-punctatus ... 160
(Chlamys) Stutchburianus 185, xxxv, 11
Stutchburiensis 185
subacutus 169, xxxi, 7—9
subinterstriatus 175, 182, 184
(*Syncyclonema*) *sublaminosus* 146, 149
(*Æquipecten*) *subpulchellus* ... 195
ternatus 191
(Neithea) triplicata 214
— (*Chlamys*) *undulatus*... 175

PAGE

Pecten (*Neithea*) *versicostatus* 201, 202, 206, 210
– (*Camptonectes*) *virgatus* 160
— (*Chlamys*) *Zeisneri* ... 175
Pectinites aculeatus 127
— *asper* ... 186
Pectunculus ... 66—70, 224
euglyphus 71, xiv, 13
marullensis 66, xiii, 9, 10
– *obliquus* ... 55
sublævis... 67, xiv, 1—7
umbonatus 69, xiv, 8—12
Vaughani ... 224, xlii, 11
Perissonota ... 11
Pinnites ungulatus ... 106
Placunopsis undulata 224
Plagiostoma brightoniensis 127, 131
spinosa 127
– *spinosum* 127
– *sulcata* 127
Plicatula ... 134–144
— æquicostata... ... 136
— Barroisi ... 141, xxvi, 12—18
Carteroniana ... 135, xxv, 5—12
— gurgitis 137, xxv, 13—21
inflata 139, xxvi, 1—11
minuta ... ... 138, xxv, 22—25
nodosa ... 141
pectinoides 137, 141
— *placunata* 134
– placunea ... ... 134, xxv, 1—4
— *radiola* 137, 139
sigillina ... 143, 225, xxvi, 19—22
— *spinosa* 139
Podopsis striata 120
Portlandia pectinata 16

Scaphula 37
Septifer 106
lineatus 106, 225, xviii, 1—12
Spondylus ... 116—134
– *æqualis* 128
– *æquicostatus* 122, 123
– *Brunneri* 117
— *capillatus* ... 119
— *dichotomus* 143
duplicatus... ... 128, 131

PAGE

Spondylus Dutempleanus 125, xxii, 11—14; xxiii, 1—5
— *Dutemplei* ... 125
— gibbosus ... 117, xx, 5—11
— latus ... 121, xxii, 1—10
— *latus*, Desh. ... 116
— *lineatus* ... 121
— *obliquus* ... 121
— *padopsideus* ... 127
— *radiatus* ... 116
— Rœmeri ... 116, xx, 4
— serratus ... 124, xxi, 6, 7
— spinosus 127, xxiii, 6—11; xxiv, 1—7
— striatus ... 119, xxi, 1—5
— *strigilis* ... 134
— *subspinosus* ... 128
— *superbus* ... 128, 132
Syncyclonema ... 145—152
— orbicularis ... 147
— *sublaminosa* ... 147

Trigonia ... 73—90
— affinis ... 77
— *alæformis* ... 83, 84
— aliformis ... 83
— Archiaciana ... 86
— carinata ... 90
— caudata ... 81
— *cincta* ... 78
— *clavellata* ... 78
— costigera ... 88
— crenulata ... 82, xix, 14
— crenulifera ... 82
— Cunningtoni ... 90
— dædalea ... 80
— *dædalea* ... 79
— debilis ... 78
— dunscombensis ... 78, xix, 12
eccentrica ... 76, 77
— Etheridgei ... 81
— exaltata ... 74

PAGE

Trigonia excentrica ... 76, 77
— Fittoni ... 88
— *hunstantonensis* ... 73
— ingens ... 75
— *Keepingi* ... 75
— *læviuscula* ... 77
— Meÿeri ... 84
— nodosa ... 78
— ornata ... 85, xix, 13
— pennata ... 88
— *pseudospinosa* ... 87
— Robinaldina? ... 74
— *rudis* ... 78
— scabricola ... 82
— scapha ... 73, xx, 1, 2
— *sinuata* ... 76, 77
— spectabilis ... 80, 224
— spinosa ... 86
— *spinosa* ... 87
— sulcataria ... 89
— tealbyensis ... 79
— upwarensis ... 86
— Vectiana ... 84
— Vicaryana ... 87
Trigonoarca ... 47, 48
— Passyana 47, viii, 9, 10

Velopecten ... 218—220
— pectinatus ... 220, xlii, 6
— Studeri 218, xli, 11; xlii, 1—4
— trilinearis 219, xlii, 5
Vola æquicostata ... 208
— *atava* ... 198
— *Dutemplei* ... 215
— *Morrisi* ... 202
— *quadricostata* ... 211, 212
— *quinquecostata* ... 203, 204, 205

Yoldia ... 3
— scapha ... 4

PRINTED BY ADLARD AND SON, LONDON AND DORKING.

The figures are of natural size *unless the amount of enlargement is stated.*

PLATE I.

Genus Nuculana, *Link.*

FIGS.

1—3. *N. spathulata* (Forbes). (P. 1.)

1. The Type. Atherfield Clay, Atherfield. Mus. Geol. Soc., No. 2112.
2. Crackers, Atherfield. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, anterior of same; *c*, same valve × 2.
3. Same horizon, locality, &c. Left valve.

4, 5. *N. subrecurva* (Phil.). Speeton Clay, Speeton. Leckenby Collection, Woodwardian Museum. (P. 2.)

4. *a*, left valve; *b*, anterior view; *c*, dorsal. Figured by Gardner.
5. *a*, right valve; *b*, dorsal view.

6, 7. *N. speetonensis*, Woods. Speeton Clay, Speeton. Museum of Practical Geology, No. 6412. (P. 3.)

6. *a*, left valve; *b*, ornament × 2.
7. *a*, left valve; *b*, dorsal view.

8—14. *N.* [*? Yoldia*] *scapha* (d'Orb.). 8—13, Atherfield Clay, Sevenoaks. (P. 3.)

8. Collection of C. J. A. Meÿer. *a*, right valve; *b*, dorsal view; *c*, ornament × 2. Figured by Gardner.
9. British Museum, No. L 9280. Left valve.
10, 11. — — Right valves.
12. Collection of C. J. A. Meÿer. Left valve.
13. — — Right valve.
14. Speeton Clay, Speeton. Woodwardian Museum. Left valve.

15—17. *N. Seeleyi* (Gardn.). Speeton Clay, Speeton. (P. 5.)

15. The Type. Leckenby Collection, Woodwardian Museum. *a*, left valve; *b*, dorsal view.
16. Woodwardian Museum. *a*, left valve; *b*, dorsal.
17. Bed C 3. Collection of G. W. Lamplugh. *a*, left valve; *b*, dorsal outline.

18—24. *N. solea* (d'Orb.). Gault, Folkestone. (P. 5.)

18, 19. Wiltshire Collection, Woodwardian Museum. Right valves.
20. Montagu Smith Collection, Woodwardian Museum. Interior of left valve × 2.
21—24. British Museum, No. L 4974. 21, 23, and 24, right valves; 22, left valve.

25—27. *N. Mariæ* (d'Orb.). Gault, Folkestone. (P. 6.)

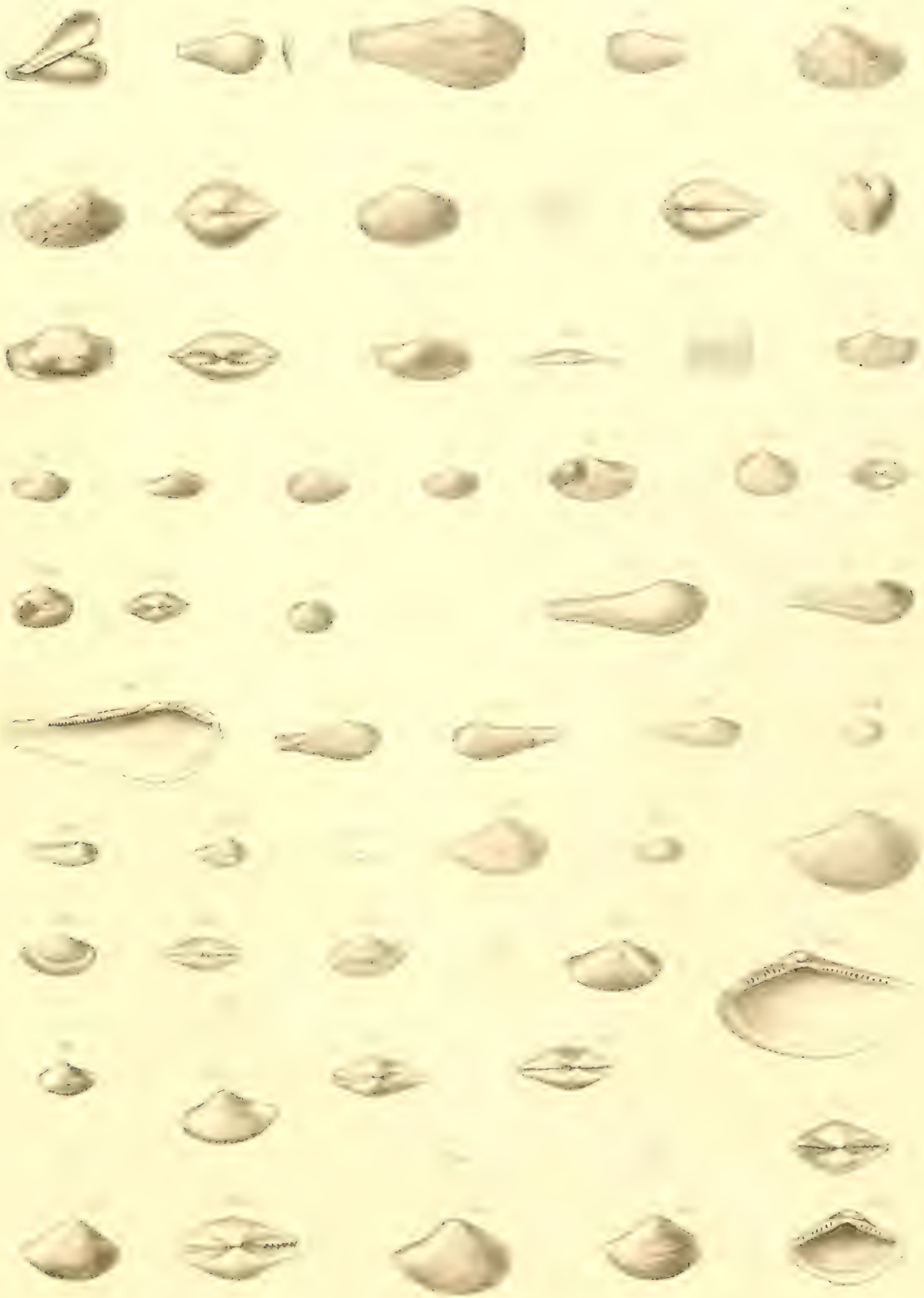
25. British Museum, No. L 4973. *a*, right valve; *b*, dorsal outline; *c*, same × 2.
26. British Museum, No. L 4973. *a*, right valve; *b*, same × 3.
27. Woodwardian Museum. Right valve.

28—32. *N. lineata* (Sow.). 28—31, Greensand, Blackdown. (P. 7.)

28. The Type, Bristol Museum. *a*, right valve; *b*, dorsal view.
29. Collection of C. J. A. Meÿer. Left valve.
30. Wiltshire Collection, Woodwardian Museum. Left valve.
31. — — — *a*, outline of left valve; *b*, same × 2; *c*, same, dorsal, × 2; *d*, interior of another specimen, right valve, × 3.
32. Lower Greensand, Atherfield. Gardner Collection, British Museum, No. L 5109. *a*, outline of right valve; *b*, same × 2; *c*, dorsal view × 2.

33—35. *N. angulata* (Sow.). Greensand, Blackdown. (P. 8.)

33. Collection of C. J. A. Meÿer. *a*, outline of right valve; *b*, same × 4; *c*, another specimen, dorsal view, × 4.
34. *a*, outline of right valve; *b*, same × 4.
35. The Types, British Museum, No. 43213. *a*, outline of right valve; *b*, same × 3; *c*, dorsal view of another specimen × 3; *d*, interior of another specimen, right valve, × 3.



F. Wilson, del. W.H. Brewer, lith.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA

PLATE II.

Nuculana (*continued*).

FIGS.

1—3. *N. phaseolina* (Mich.). Gault, Folkestone. (P. 9.)

1. British Museum, No. L 5106. *a*, left valve; *b*, dorsal view; *c*, posterior; *d*, left valve × 2.
2, 3. British Museum, No. L 4969. 2 *a*, right valve; 2 *b*, same × 3; 3, left valve.

4—9. *N. Vibrayeana* (d'Orb.). 4—8, Gault, Folkestone. British Museum, No. L 4971. (P. 10.)

4. *a*, right valve; *b*, same × 2; *c*, dorsal view × 2.
5. *a*, right valve; *b*, dorsal view.
6—8. Left valves.
9. Cambridge Greensand (derived from Gault). The Type of *N. subelliptica*, Seeley, Carter Collection, Woodwardian Museum. Right valve; natural internal mould.

10. *N. sp.*, cf. *siliqua* (Goldf.). Chalk Rock (zone of *Het. Reussianum*), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. *a*, internal mould of left valve; *b*, mould of teeth × 3. (P. 11.)

Genus Nucula, *Lamarck*.

11—15. *N. planata*, Desh. 11—13, Speeton Clay, Speeton. Leckenby Collection, Woodwardian Museum. (P. 12.)

11. *a*, right valve; *b*, dorsal view. Figured by Gardner, Quart. Journ. Geol. Soc., xl (1884), pl. v, f. 3.
12. *a*, right valve; *b*, dorsal view.
13. Right valve, somewhat crushed. Figured by Gardner, *ibid.*, pl. v, f. 2.
14 Crackers, Atherfield. Woodwardian Museum. *a*, left valve; *b*, dorsal view. Figured by Gardner, *ibid.*, pl. v, f. 1.
15. Crackers, Atherfield. Leckenby Collection, Woodwardian Museum. Right valve.

16, 17. *N. sp.* Claxby Ironstone (zone of *Belemnites lateralis*), Benniworth Haven. Woodwardian Museum. (P. 13.)

16. *a*, left valve; *b*, same, interior filled with oolitic ironstone; *c*, same, posterior; *d*, same, dorsal. Figured by Gardner (as *N. Cornueliana*, d'Orb.), Quart. Journ. Geol. Soc., xl (1884), pl. v, f. 5, 6.
17. Right valve.

18, 19. *N. Lamplughi*, Woods. Speeton Clay (D 4), Speeton. Collection of G. W. Lamplugh. (P. 14.)

18. *a*, right valve; *b*, dorsal view.
19. Left valve.

20. *N. sp.* Lower Greensand, Atherfield. British Museum. (P. 14.)

a, left valve, outline; *b*, same × 2; *c*, same, dorsal view of both valves × 2; *d*, same, posterior view × 2.

21. *N. Meÿeri*, Gardn. Lower Greensand, Atherfield. British Museum. The Type. (P. 15.)

a, left valve, outline; *b*, same × 2; *c*, same, dorsal view of both valves × 2.

22—27. *N. pectinata*, Sow. Gault, Folkestone (except f. 24). (P. 16.)

22. Montagu Smith Collection, Woodwardian Museum. Right valve.
23. Woodwardian Museum. *a*, right valve; *b*, same, posterior view; *c*, same, dorsal.
24. Gault, Aylesford. Woodwardian Museum. Right valve.
25. Woodwardian Museum. Left valve.
26. Wiltshire Collection, Woodwardian Museum. Left valve.
27. Woodwardian Museum. *a*, left valve; *b*, posterior view; *c*, portion of ornamentation of left valve enlarged.

PLATE III.

Nucula (*continued*).

FIGS.

1—12. *N.* (*Acila*) *bivirgata*, Sow. Gault, Folkestone (except f. 12). (P. 19.)

1. Woodwardian Museum. Right valve × 1½.
2. British Museum, No. L 5907. *a*, outline of left valve; *b*, same × 1½; *c*, dorsal outline. Figured by Gardner.
3. Wiltshire Collection, Woodwardian Museum. Right valve × 1½.
4. British Museum, No. L 5907. Left valve × 1½. Figured by Gardner.
5. — No. L 4972. *a*, right valve; *b*, posterior end; *c*, dorsal × 1½.
6. — — Left valve × 1½.
7. — — Median portion of left valve × 1½.
8. — — Median portion of right valve × 1½.
9. — — Left valve × 1½.
10. — No. L 5102. Hinge of right valve × 2.
11. Collection of C. J. A. Meÿer. Antero-ventral portion of left valve × 6.
12. Cambridge Greensand. Woodwardian Museum. Internal mould, right valve.

13. *N. pectinata*, Sow. Cambridge Greensand (derived). Woodwardian Museum. Internal mould. *a*, right valve; *b*, dorsal view. (P. 16.)

14, 15. *N. pectinata*, var. *cretæ*, Gardner. Greensand, Blackdown. Museum of Practical Geology. The Types of var. *cretæ*. (P. 18.)

14. *a*, right valve; *b*, dorsal (No. 6449).
15. Left valve (No. 6450).

16—21. *N. ovata*, Mant. Gault, Folkestone. (P. 21.)

16. British Museum, No. L 4968. Right valve.
17. Wiltshire Collection, Woodwardian Museum. Right valve.
18—20. British Museum, No. L 4968. 18, right valve. 19. *a*, left valve; *b*, dorsal view; 20, right valve.
21. Woodwardian Museum. *a*, right valve; *b*, dorsal.

A Brock del. W.E. Sowerby sculp.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA.

PLATE IV.

Nucula (*continued*).

FIGS.

1. *N. ovata*, Mant. Gault, Folkestone. British Museum, No. L 4968. *a*, right valve; *b*, dorsal. (P. 21.)

2—4. *N. obtusa*, Sow. Greensand, Blackdown. (P. 22.)

2. The Type, Bristol Museum. *a*, right valve; *b*, posterior view of same.
3. Museum of Practical Geology, No. 6351. Right valve.
4. — — — Left valve. Figured by Gardner.

a, left valve; *b*, posterior of same; *c*, dorsal of same; *d*, hinge × 2.

5—8. *N. impressa*, Sow. Greensand, Blackdown. (P. 23.)

5. Wiltshire Collection, Woodwardian Museum. Right valve.
6. — — — — *a*, left valve; *b*, dorsal; *c*, posterior.
7. Wiltshire Collection, Woodwardian Museum. Interior of right valve × 2.
8. Probably the type of *N. apiculata*, Sowerby. Museum of the Geological Society, No. 1564. *a*, right valve; *b*, dorsal view.

9—16. *N. albensis*, d'Orb. Gault, Folkestone. (P. 24.)

9. Museum of Practical Geology, No. 1638. *a*, right valve; *b*, dorsal view.
10. Wiltshire Collection, Woodwardian Museum. Left valve.
11. Woodwardian Museum. Right valve.
12. British Museum, No. 4963. *a*, left valve; *b*, dorsal view.
13. — — — — —
14. Woodwardian Museum. *a*, left valve; *b*, dorsal view.
15. Collection of C. J. A. Meÿer. *a*, left valve; *b*, dorsal view.
16. Wiltshire Collection, Woodwardian Museum. Left valve.

17. *N. albensis?* d'Orb. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. Right valve. (P. 25.)

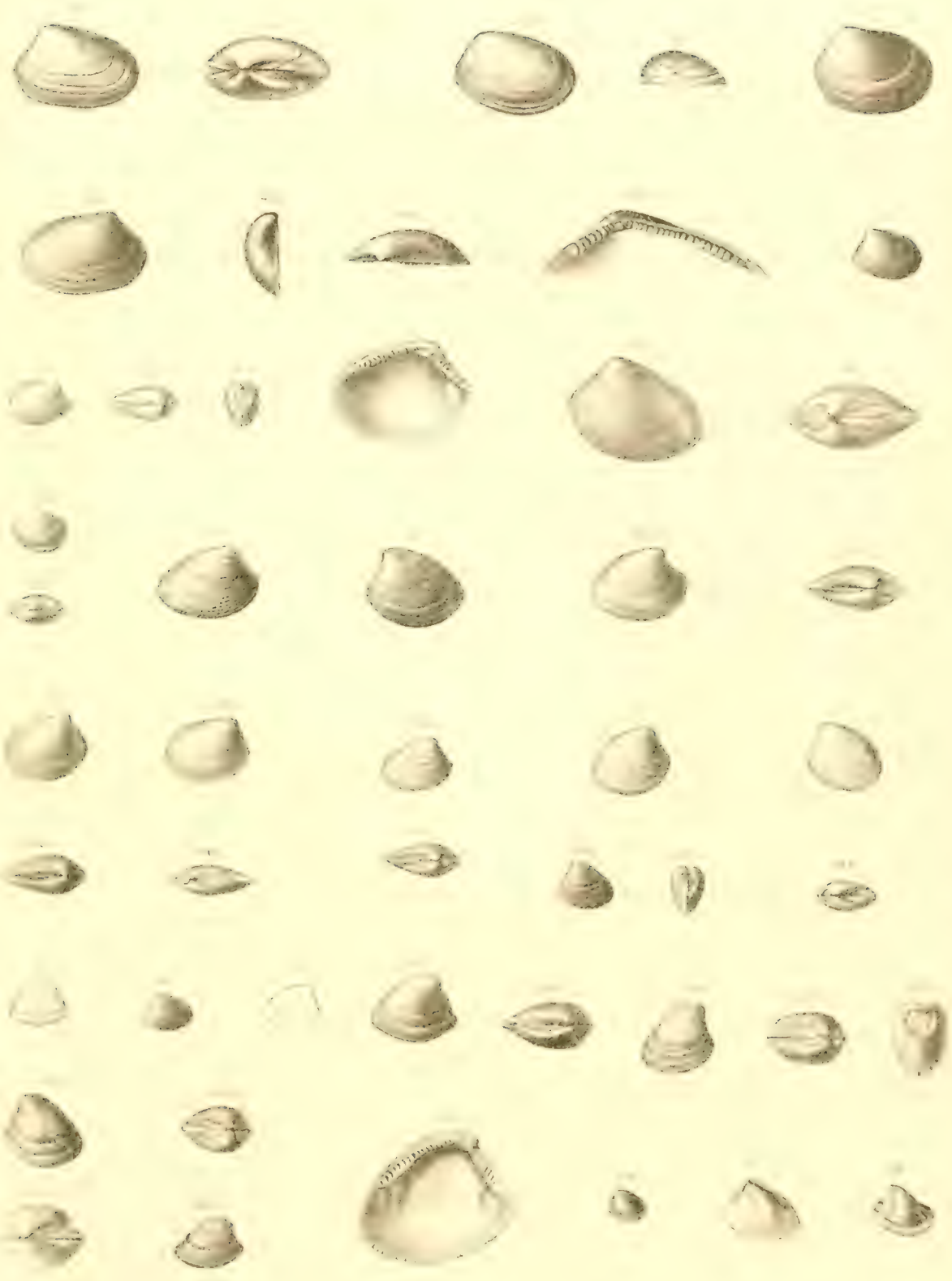
18—21. *N. gaultina*, Gardn. Gault, Folkestone. British Museum, No. 4970. (P. 25.)

18. *a*, right valve; *b*, posterior; *c*, dorsal.
19. Left valve.
20. Right valve.
21. *a*, left valve, outline; *b*, same × $1\frac{1}{2}$; *c*, dorsal × $1\frac{1}{2}$.

22—26. *N. antiquata*, Sow. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. (P. 26.)

22. *a*, left valve; *b*, dorsal view; *c*, posterior.
23. *a*, right valve; *b*, dorsal view.
24. *a*, dorsal view; *b*, left valve.
25. Interior of right valve × 2.
26. Right valve.

27, 28. *N. sp.* Chalk Rock (zone of *Het. Reussianum*), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. Internal moulds of right valves. (P. 27.)



J. Morris del. et lith. Strother & Co.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA.

PLATE V.

Genus ANOMIA, *Linnæus.*

FIGS.

1—3. *A. pseudoradiata*, d'Orb. Lower Greensand. (P. 27.)

1. Crackers, Atherfield. Woodwardian Museum. *a*, outline of left valve; *b*, same × 1½; *c*, ornament of same × 6.
2. Atherfield Beds, Redhill. British Museum, No. L 9288. Left valve.
3. Atherfield. Museum of the Geological Society. Left valve (young specimen) × 1½.

4, 5. *A. sp.* Crackers, Atherfield. (P. 28.)

4. Woodwardian Museum. Left valve.
5. Wiltshire Collection, Woodwardian Museum. *a*, left valve, outline; *b*, same × 2.

6—9. *A. lævigata*, Sow. Lower Greensand. (P. 29.)

6. Museum of Practical Geology, No. 6414. Hythe Beds, Lympne. ? Interior of left valve. One of the Types.
7. Museum of Practical Geology, No. 6415. Atherfield Beds, Peasmarsh. *a*, left valve; *b*, dorsal view of same.
8. Museum of Practical Geology, No. 6417. Punfield. *a*, left valve; *b*, dorsal.
9. Collection of C. J. A. Meÿer. Ferruginous Sands, Shanklin. Left valve.

10. *A. convexa*, Sow. Lower Greensand, Shanklin. Museum of the Geological Society, No. 2032. *a*, left valve; *b*, dorsal view. (P. 29.)

11. *A.* cf. *pseudoradiata*, d'Orb. Gault, Black Ven. Museum of Practical Geology, No. 6440. *a*, left valve; *b*, portion × 3. (P. 30.)

12. *A. ? transversa*, Seel. Cambridge Greensand. Woodwardian Museum. *a*, left valve; *b*, dorsal view of same. (P. 30.)

13—16. *A. papyracea*, d'Orb. Lower Chalk—Totternhoe Stone (zone of *Holaster subglobosus*). (P. 31.)

13. Woodwardian Museum. Burwell. Left valve. Figured by Etheridge. The dorsal part of the shell is crushed, giving the umbo the appearance of being at the margin.
14. York Museum. Reach. Left valve. Dorsal part of shell is crushed.
15. Woodwardian Museum. Burwell. Left valve. Figured by Etheridge.
16. Woodwardian Museum. Right valve.

T.M.Brooks del. W.H.Crowther lith.

CRETACEOUS LAMELLIBRANCHIA

PLATE VI.

Genus Arca, *Lamarck.*

FIGS.

1—3. *A. Dupiniana*, d'Orb. (P. 32.)

1, 2. *Perna*-bed, Atherfield. Leckenby Collection. Woodwardian Museum. 1 *a*, right valve; 1 *b*, dorsal view of same specimen; 2, hinge of left valve × 1½.

3. Ferruginous Sands, Shanklin. Collection of C. J. A. Meÿer. Ornamentation on the right valve near the ventral margin below the umbones × 3.

4, 5. *A. Carteroni*, d'Orb. (P. 33.)

4. Lower Greensand, Upware. Woodwardian Museum. *a*, left valve; *b*, anterior view; *c*, dorsal of same specimen. Figured by Keeping.

5. Atherfield Beds, East Shalford. Collection of C. J. A. Meÿer. *a*, left valve; *b*, hinge and area of same × 1½; *c*, ornamentation, from the anterior part of the valve, × 3.

6, 7. *A. Sanctæ-Crucis*, Pict. and Camp. Lower Greensand, Upware. Woodwardian Museum. (P. 34.)

6. *a*, left valve; *b*, outline of anterior end; *c*, dorsal view of same specimen. (The right umbo and the anterior part of the area are partly obscured by adhering rock.)

7. *a*, right valve; *b*, dorsal view of same specimen; *c*, ornamentation × 2.

Genus Barbatia, *Gray.*

8, 9. *B. aptiensis* (d'Orb.). Crackers, Atherfield. Leckenby Collection, Woodwardian Museum. (P. 35.)

8. *a*, left valve; *b*, dorsal; *c*, right valve; *d*, anterior; *e*, part of left valve near the mid-ventral margin × 3.

9. *a*, left valve; *b*, right valve.

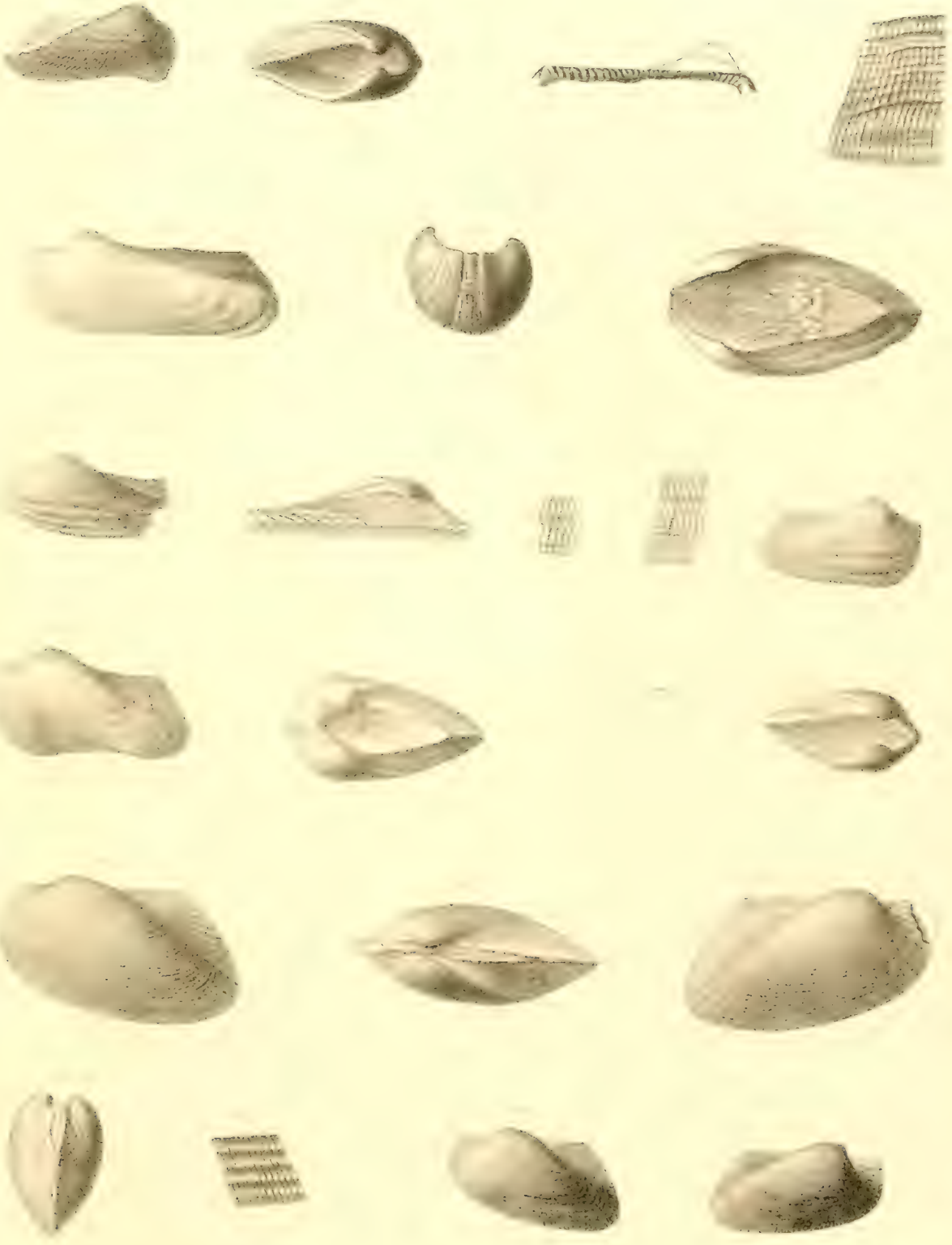


PLATE VII.

Barbatia (*continued*).

FIGS.

1—3. *B.* (*Scaphula?*) *Austeni* (Forbes). (P. 37.)

1, 2. Crackers, Atherfield, Leckenby Collection, Woodwardian Museum. 1 *a*, right valve; 1 *b*, ornamentation near postero-ventral angle × 3. 2. Dorsal view of another specimen × 2.

3. Left valve. *Perna*-bed, Redcliff. Collection of C. J. A. Meÿer.

4—7. *B. marullensis* (d'Orb.). (P. 38.)

4. Left valve. Lower Greensand, Upware. Woodwardian Museum.

5. Gault (zone iii), Folkestone. Museum of Practical Geology, No. 1630. *a*, right valve; *b*, dorsal view of same specimen; *c*, ornamentation on postero-dorsal area × 4; *d*, ornamentation from near the middle of the valve × 4.

6. Gault, Folkestone. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal view of same specimen.

7. Gault, Folkestone. Museum of Practical Geology, No. 6559. Right valve.

8. *B. rotundata* (Sow.). Greensand, Blackdown. The Type, Bristol Museum. *a*, right valve; *b*, dorsal view; *c*, same × 2. (P. 40.)

9. *B. Galliennei* (d'Orb.). Chalk Marl, near Lyme Regis. Wiltshire Collection, Woodwardian Museum. Internal mould. *a*, right valve; *b*, dorsal view of same specimen. (P. 41.)

10, 11. *B. sp.*, cf. *Geinitzi* (Reuss). Chalk Rock (zone of *Het. Reussianum*), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. (P. 42.)

10. *a*, portion of wax mould of right valve; *b*, ornamentation × 5.

11. Natural internal mould of right valve.

12. *B. sp.* Same locality and Collection. *a*, internal cast of left valve; *b*, dorsal view of same. (P. 42.)

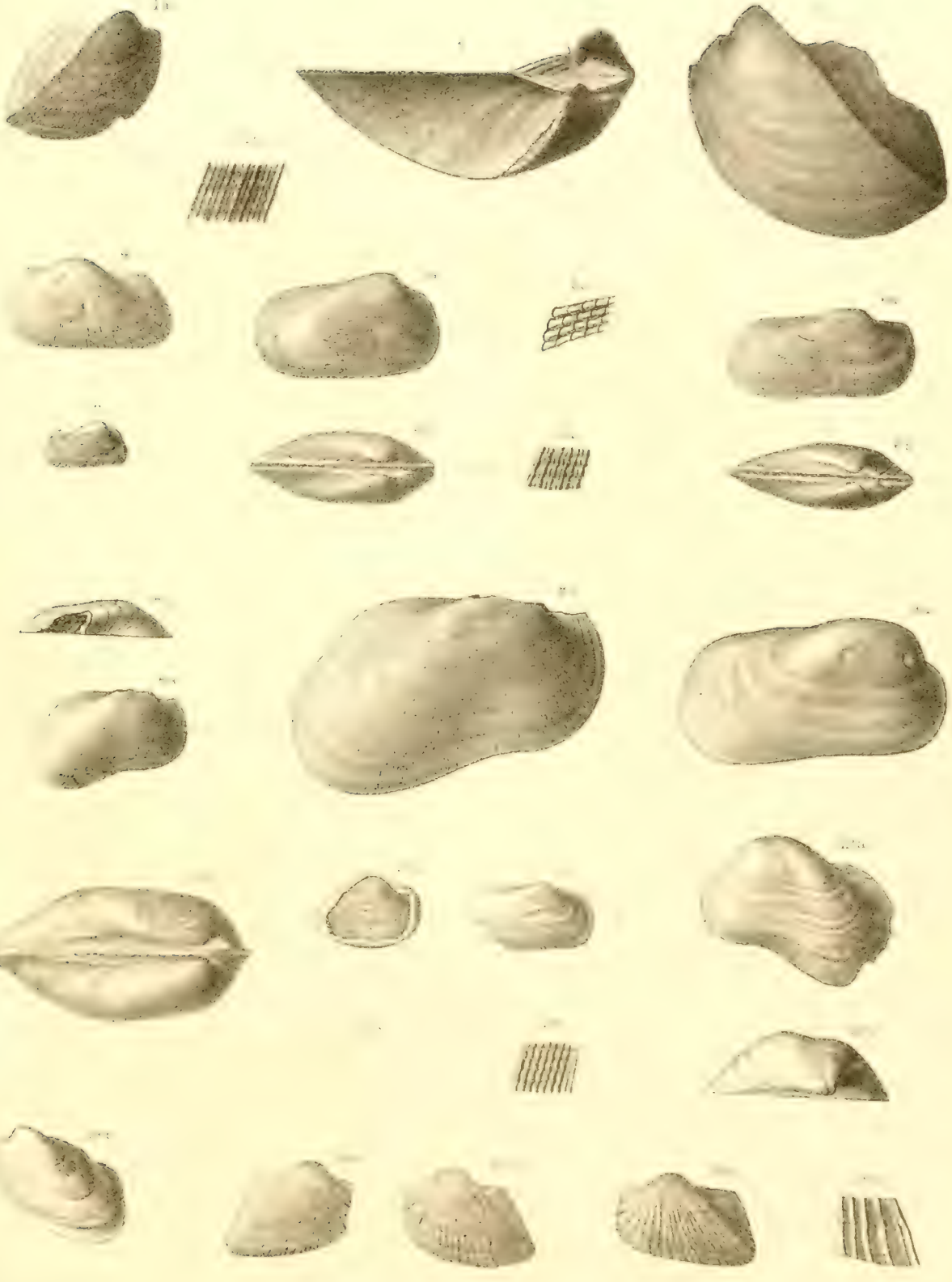
13. *B.? sp.* Same locality and Collection. *a*, left valve, outline natural size; *b*, same × 2. (P. 43.)

Genus Grammatodon, *Meek and Hayden.*

14, 15. *G. securis* (Leymerie). Speeton Clay (zone of *Bel. brunsvicensis*), Speeton. Collection of G. W. Lamplugh. (P. 44.)

14. *a*, *b*, right and left valves of same specimen.

15. *a*, left valve; *b*, ornamentation × 3.



T.A.Brock del.
W.H.Crowther lith.

West, Newman imp

CRETACEOUS LAMELLIBRANCHIA.

PLATE VIII.

Grammatodon (*continued*).

FIGS.

1, 2. *G. securis* (Leym.), Speeton Clay (zone of *Bel. brunsvicensis*), Speeton. (P. 44.)

1. Collection of G. W. Lamplugh. Dorsal view × 2.
2. York Museum. Left valve, with part of shell preserved.

3—8. *G. carinatus* (Sow.). (P. 45.)

3. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. *a*, outline of left valve; *b*, same × 1½; *c*, dorsal view of same × 1½; *d*, hinge and area of same × 2.
4. Same locality and Collection. *a*, left valve; *b*, dorsal; *c*, anterior view.
5. Same locality and Collection. Right valve.
6. Gault, Lyme Regis. Woodwardian Museum. Left valve.
7. Gault (zone ii), Folkestone. Museum of Practical Geology, No. 1632. *a*, right valve; *b*, dorsal.
8. Gault, Folkestone. Wiltshire Collection, Woodwardian Museum. Left valve. The ventral part is crushed in, so that the shell appears too long proportionately.

Genus Trigonoarca, *Conrad.*

9, 10. *T. Passyana* (d'Orb.). (P. 47.)

9. Greensand, Kingskerswell. British Museum, No. L 1853. *a*, right valve; *b*, cast of hinge; *c*, ornamentation × 3.
10. Chloritic Marl, Maiden Bradley. Woodwardian Museum. Internal cast. *a*, right valve; *b*, dorsal.

Genus Cucullæa, *Lamarck.*

11—13. *C. Cornueliana* (d'Orb.). Lower Greensand, Atherfield. (P. 50.)

11. Right valve. Woodwardian Museum. Above the Crackers.
12. Right valve. Woodwardian Museum. Crackers.
13. Left valve. Woodwardian Museum. Above the Crackers.

CRETACEOUS LAMELLIBRANCHIA.

PLATE IX.

FIGS.

1—3. *Cucullæa Forbesi* (Pict. and Camp.). *Perna*-bed, Atherfield. (P. 49.)

1. Wiltshire Collection, Woodwardian Museum. Left valve.
2. Woodwardian Museum. *a*, dorsal; *b*, anterior of right valve; *c*, part of *b* × 3.
3. Wiltshire Collection, Woodwardian Museum. *a*, hinge and area of left valve; *b*, exterior of left valve.

T.A. Brock del.
W. L. Crowney lith.

CRETACEOUS AMELLIBRANCHIATA

PLATE X.

Cucullæa (*continued*).

FIGS.

1—3. *C. Cornueliana* (d'Orb.). Crackers, Atherfield. (P. 50.)

1. Leckenby Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal outline; *c*, ornamentation × 4.
2. Leckenby Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal.
3. Woodwardian Museum. Hinge × 2.

4—7. *C. Fittoni* (Pict. and Camp.). Crackers, Atherfield. (P. 52.)

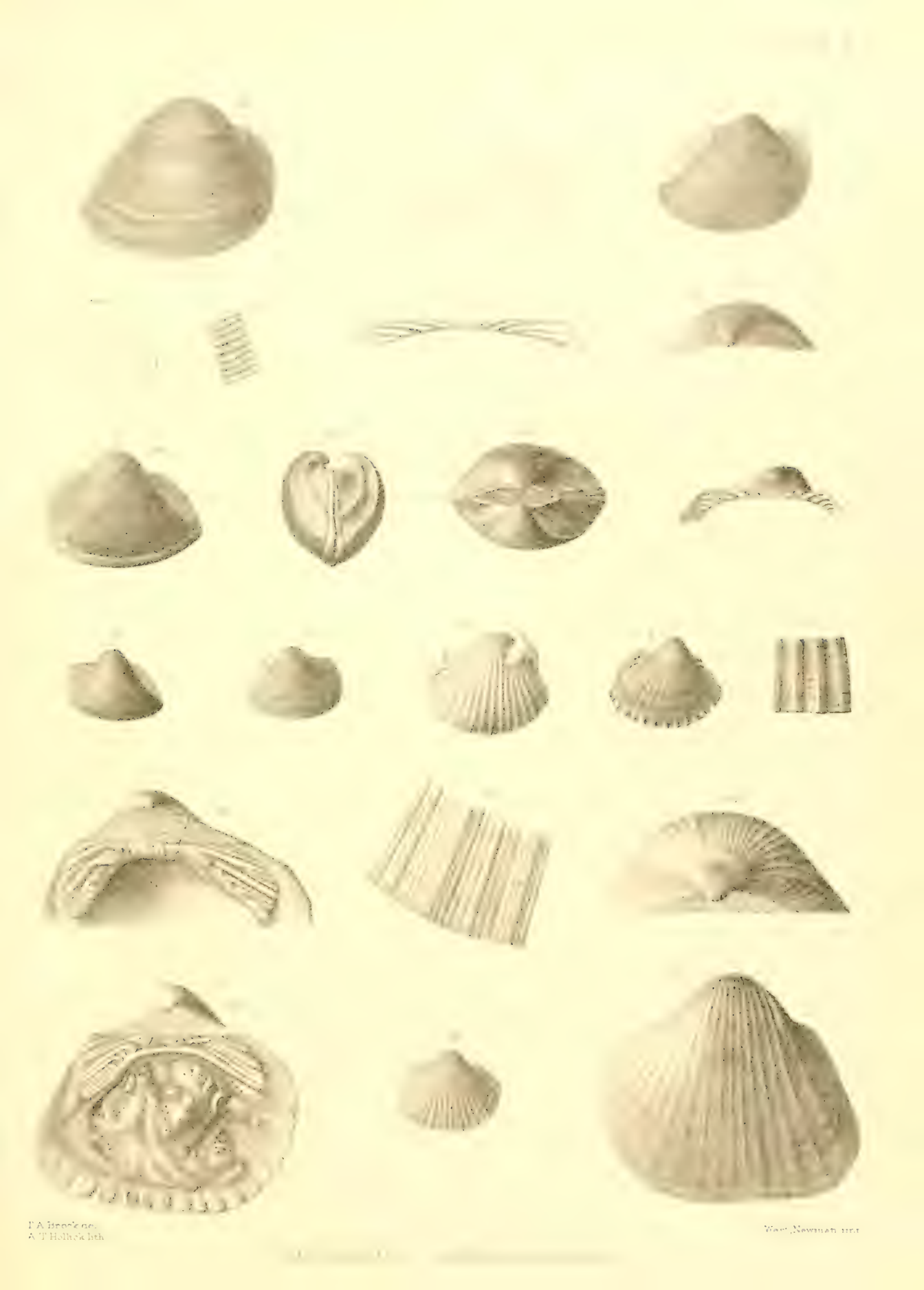
4. Leckenby Collection, Woodwardian Museum. *a*, outline of left valve; *b*, same × $1\frac{1}{2}$; *c*, posterior of same × $1\frac{1}{2}$; *d*, dorsal of same × $1\frac{1}{2}$.
5. Woodwardian Museum. Hinge and area × 2.
6. Leckenby Collection. Left valve.
7. Wiltshire Collection. Right valve.

8—10. *C. vagans*, Keeping. Lower Greensand (Black-grit nodule), Upware. Woodwardian Museum. (P. 52.)

8. Drawn from a wax mould of an external cast. Right valve.
9. Natural internal mould. Right valve. Figured by Keeping.
10. Ornamentation × 3.

11—14. *C.* (*Dicranodonta*) *donningtonensis*, Keeping. Claxby Ironstone (zone of *Belemnites lateralis*), Benniworth Haven. Woodwardian Museum. (P. 54.)

11. *a*, left valve; *b*, dorsal; *c*, interior.
12. Hinge of left valve.
13. Ornamentation × 3.
14. Right valve.



T.A. Brock sc.
A.T. Holbrook lith.

Geo. Newman ad.

PLATE XI.

Cucullæa (*continued*).

FIGS.

1, 2. *C.* (*Dicranodonta*) *donningtonensis*, Keeping. Claxby Ironstone (zone of *Belemnites lateralis*), Benniworth Haven. Woodwardian Museum. (P. 54.)

1. *a*, left valve; *b*, interior.
2. Right valve.

3, 4. *C.* (*Dicranodonta ?*) *obliqua* (Keeping). Lower Greensand, Upware. Woodwardian Museum. (P. 55.)

3. *a*, right valve, outline; *b*, same × 1½; *c*, dorsal.
4. Left valve, interior.

5—7. *C. venusta*, Nyst. Greensand, Blackdown. (P. 56.)

5. The Type, Bristol Museum. Left valve. *a*, dorsal outline; *b*, outline; *c*, same × 2.
6. The Type, Bristol Museum. Left valve. *a*, outline; *b*, same × 2.
7. Collection of C. J. A. Meÿer. *a*, right valve × 3 (the outer layers of the shell are absent, so that the apparent ornamentation differs from that in figs. 5 and 6); *b*, dorsal view of same × 3.

8—12. *C. glabra*, Parkinson. Greensand, Blackdown. (P. 57.)

8. British Museum, No. 26926. *a*, left valve; *b*, dorsal of same specimen; *c*, ornamentation × 6.
9. Wiltshire Collection, Woodwardian Museum. *a*, left valve; *b*, dorsal view.
10. Woodwardian Museum. Hinge of the left valve of a young form × 4.
11. Wiltshire Collection, Woodwardian Museum. Hinge of right valve—later stage than fig. 10—× 2.
12. Woodwardian Museum. Hinge of right valve × 1½.

T. A. Brock del.
A. T. Hollick lith.

Arnt. Newman imp.

CRETACEOUS LAMELLIBRANCHIA

PLATE XII.

Cucullæa (*continued*).

FIGS.

1—5. *C. glabra*, Parkinson. Greensand, Blackdown. (P. 57.)

1 *a*, *b*, 2. Wiltshire Collection, Woodwardian Museum. Left valves.

3. Woodwardian Museum. *a*, right valve; *b*, dorsal view of same specimen.

4. — — Left valve.

5. Elongate variety. Wiltshire Collection, Woodwardian Museum. Left valve.

6—8. *C. obesa*, Pict. and Camp. Gault. (P. 61.)

6. Folkestone. Wiltshire Collection, Woodwardian Museum. Young form. Right valve.

7. Same locality and Collection. *a*, left valve; *b*, dorsal view of same.

8. Cambridge Greensand (derived from the Gault). Woodwardian Museum. Internal cast. *a*, left valve; *b*, posterior view.

T A Brock del
W H Crowther lith.

West, Newman imp

CRETAC . . LAMELLIBRANCH

PLATE XIII.

Cucullæa (*continued*).

FIGS.

1—3. *C. nana*, Leym. Gault, Folkestone. British Museum, No. L 4946. (P. 62.)

1. *a*, left valve; *b*, dorsal of same; *c*, same × 2; *d*, left × 2; *e*, anterior view × 1½. (The umbo is slightly pressed in, and consequently in 1 *a*, *d*, appears less sharp than usual.)
2. Right valve × 2.
3. Left valve; the posterior margin is slightly imperfect. × 1½.

4, 5. *C. Mailleana* (d'Orb.). (P. 63.)

4. Chalk Marl, Pinhay Cliffs. Collection of C. J. A. Meÿer. *a*, left valve; *b*, same, × 1½; *c*, same, dorsal, × 1½.
5. Chloritic Marl, Maiden Bradley. Woodwardian Museum. With the shell partly removed. *a*, right valve; *b*, dorsal of same specimen.

6. *C.*, sp. Chalk Marl (Bed 10), Dunscombe. Collection of C. J. A. Meÿer. *a*, right valve; *b*, dorsal outline; *c*, ornamentation × 4. (P. 64.)

Genus Isoarca, *Münster*.

7. *I. Agassizi*, Pict. and Roux. Cambridge Greensand (derived). Internal mould. Figured by Jukes-Browne. Woodwardian Museum. *a*, left valve; *b*, dorsal. (P. 65.)

8. *I. obesa* (d'Orb.). Chloritic Marl, Ball Wood. Museum of Practical Geology, No. 6349. *a*, left valve; *b*, dorsal; *c*, ornamentation × 5. (P. 65.)

Genus Pectunculus, *Lamarck*.

9, 10. *Pectunculus marullensis*, Leym. Ferruginous Sands, Shanklin. Collection of C. J. A. Meÿer. (P. 66.)

9. Left valve. *a*, × 2; *b*, interior; *c*, dorsal outline.
10. Left valve × 3 (another specimen).

PLATE XIV.

Pectunculus (*continued*).

FIGS.

1—7. *P. sublævis*, Sow. Greensand, Blackdown. (P. 67.)

1 *a—c*. Wiltshire Collection, Woodwardian Museum. Right valve.

2 *a*, *b*. Walton Collection, Woodwardian Museum. Right valve.

3. Wiltshire Collection, Woodwardian Museum. Right valve. *a*, interior; *b*, dorsal; *c*, exterior × 2; *d*, ornament of same × 5.

4. Same Collection. Young form. *a*, left valve; *b*, same × 2; *c*, dorsal outline.

5. Same Collection. *a*, *b*, right valve; *c*, dorsal outline.

6, 7. Museum of Practical Geology, No. 6573. Left valves.

8—12. *P. umbonatus* (Sow.). Greensand, Blackdown. (P. 69.)

8. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, outline of interior of same; *c*, dorsal outline.

9. Walton Collection, Woodwardian Museum. *a*, left valve × 1½; *b*, dorsal × 1½; *c*, ornamentation × 5.

10. Same Collection. *a*, left valve; *b*, interior; *c*, dorsal.

11. Wiltshire Collection, Woodwardian Museum. Right valve.

12. Museum of Practical Geology, No. 6572. Right valve.

13. *P. euglyphus*, Woods. Chalk Marl (Bed ii), Dunscombe. Collection of C. J. A. Meÿer. (P. 71.)

13. *a*, right valve, outline; *b*, dorsal outline of same; *c*, ornamentation on anterior part of shell × 4; *d*, ornamentation on posterior part of shell × 4; *e*, same valve × 2.

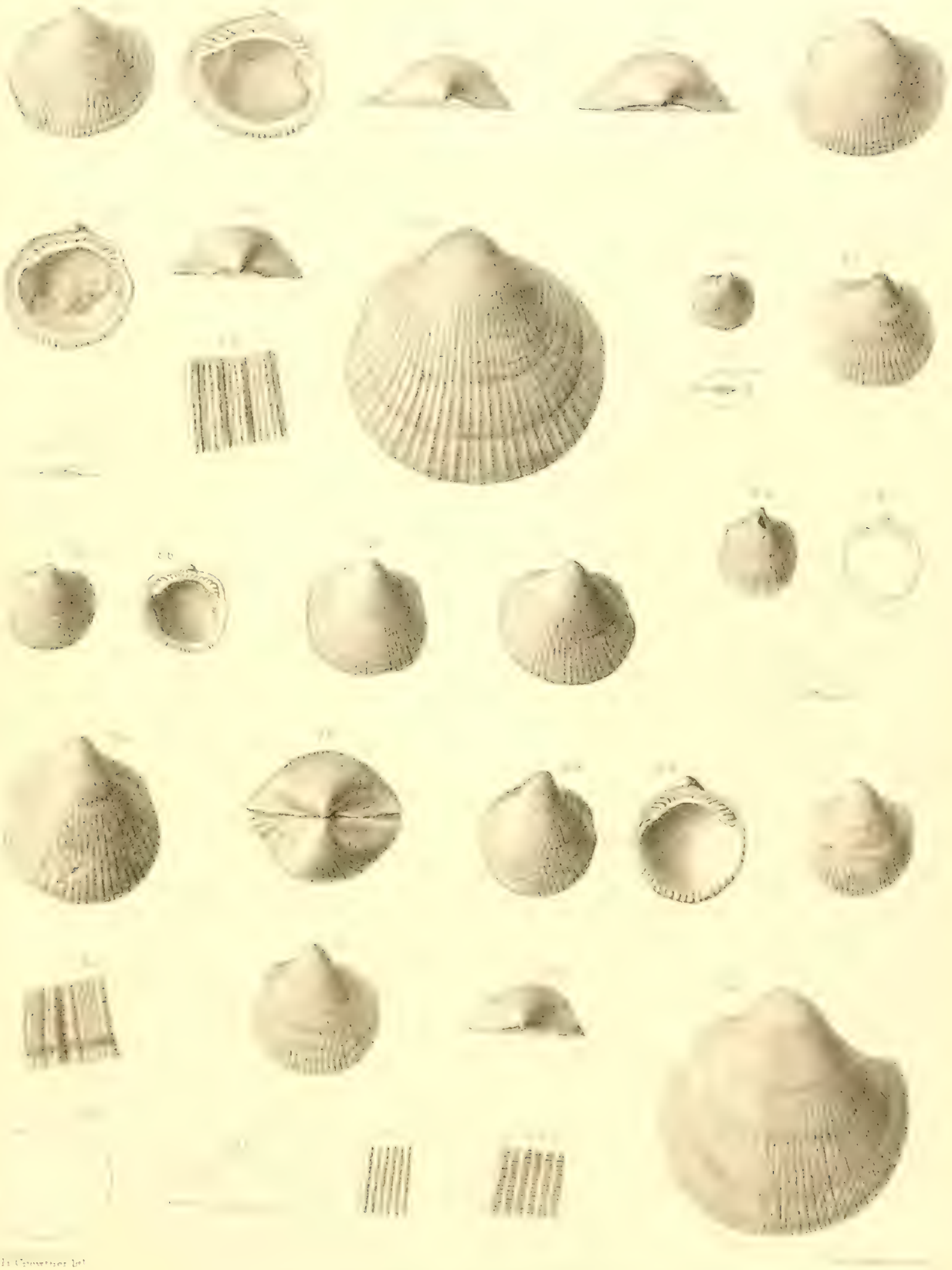


PLATE XV.

Genus—LIMOPSIS, *Sasso.*

FIGS.

1—4. *L. albiensis*, Woods. Gault, Folkestone. (P. 71.)

1. Zone iii. Left valve. Museum of Practical Geology. *a*, outline; *b*, dorsal outline; *c*, exterior × 3; *d*, interior × 4.
2. Zone vii. Right valve × 4. Same museum.
3. Right valve × 3. Same museum.
4. Zone ii. Part near umbo × 8. Same museum.

5, 6. *L.*, sp. Chalk Rock (*Reussianum* zone), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. (P. 72.)

5. Cast of interior of right valve. *a*, outline; *b*, dorsal outline; *c*, same × 2
6. Cast of interior of left valve. *a*, outline; *b*, dorsal outline; *c*, same × 2.

Genus—MYTILUS, *Linnæus.*

7. *M. inæquivalvis*, Sow. Greensand, Blackdown. The Type. Bristol Museum. *a*, right valve; *b*, left; *c*, antero-ventral; *d*, interior of right valve near the umbo × 2. (P. 91.)

Genus—MODIOLA, *Lamarck.*

8—14. *M. æqualis*, Sow. Crackers, Atherfield. (P. 92.)

8. Leckenby Collection, Woodwardian Museum. *a*, right valve, outline; *b*, same × 1½; *c*, dorsal of both valves.
9. Wiltshire Collection, Woodwardian Museum. Right valve.
10. Same Collection. Dorsal.
11—13. Same Collection. 11, left valve; 12, right valve (slightly crushed dorso-ventrally); 13, left valve
14. Woodwardian Museum. Right valve.

15—18. *M. reversa*, Sow. Greensand, Blackdown. (P. 94.)

15. Wiltshire Collection. Right valve, young form.
16. Wiltshire Collection. Left valve, young form.
17. Wiltshire Collection. *a*, right valve; *b*, dorsal outline of same.
18. Woodwardian Museum. *a*, left valve; *b*, dorsal of same; *c*, portion just posterior to middle of the sulcus, showing radial ribs × 3.

T.A.Brock del.
A.T.Hollick lith.

LAMELLIBRANCHIA

PLATE XVI.

Modiola (*continued*).

Figs.

1—3. *M. reversa*, Sow. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. (P. 94.)

1. Right valve.
2. *a*, right valve; *b*, dorsal of both valves.
3. Ornamentation, a little posterior to the centre of the valve × 4.

4—6. *M. ligeriensis* (d'Orb.). *Perna*-bed, Atherfield. (P. 96.)

4. Wiltshire Collection. *a*, left valve; *b*, dorsal of both valves.
5. Leckenby Collection. *a*, left valve; *b*, dorsal of both valves.
6. Leckenby Collection. Part adjoining middle of ventral edge × 2.

7—10. *M. subsimplex* (d'Orb.). Crackers, Atherfield. (P. 97.)

7. Leckenby Collection, Woodwardian Museum. Right valve.
8. Wiltshire Collection, Woodwardian Museum. Left valve.
9. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal of both valves.
10. Museum of the Geological Society of London (No. 2078). *a*, left valve; *b*, dorsal of both valves.

PLATE XVII.

Modiola (*continued*).

Figs.

1, 2. *M. flagellifera*, Forbes. (P. 99.)

1. Upper Greensand, Devizes. British Museum, No. 88,845. Right valve, slightly compressed dorso-ventrally.
2. Upper Greensand, Black Ven. Museum of Practical Geology, No. 6658. Dorsal view of both valves, somewhat compressed dorso-ventrally.

3. *M. undulata* (Forbes). Atherfield Clay, Atherfield. The Type. Museum of the Geological Society, No. 2088. Left valve. (P. 100.)

4, 5. *M.* (*Brachydontes*) *Guerangeri ?* (d'Orb.). (P. 101.)

4. Greensand, Haldon. Mr. W. Vicary's Collection. Left valve.
5. Cenomanian (Bed 10), Dunscombe. Mr. Meÿer's Collection. *a*, left valve; *b*, ventral of same; *c*, part of $a \times 2$.

6—8. *M.* (*Brachydontes*) *vectiensis*, Woods. (P. 102.)

6. Crackers, Atherfield. Woodwardian Museum. *a*, outline of left valve; *b*, same $\times 2$.
7. Atherfield Beds, Peasmarsh. Museum of the Geological Society, No. 2092. Right valve. *a*, outline; *b*, $\times 2$; *c*, dorsal $\times 2$.
8. Atherfield Beds, Littleton Pit, Guildford. Museum of Practical Geology. Right valve $\times 1\frac{1}{2}$. Drawn from a wax cast of an external mould.

9—11. *M.* (*Brachydontes*) *striato-costata* (d'Orb.). Greensand, Blackdown. (P. 103.)

9. Mr. Meÿer's Collection. Left valve. *a*, outline; *b*, $\times 2$.
10. Wiltshire Collection. Right valve. *a*, outline; *b*, $\times 3$.
11. Mr. Meÿer's Collection. Left valve. *a*, outline; *b*, $\times 2$; *c*, dorsal $\times 2$.

Genus—Crenella, *Brown.*

12, 13. *Crenella bella* (Sow.). Crackers, Atherfield. Wiltshire Collection. (P. 104.)

12. Right valve. *a*, outline; *b*, $\times 2$.
13. Left valve. *a*, outline; *b*, $\times 2$; *c*, dorsal $\times 2$; *d*, ornamentation from the dorsal surface $\times 6$.

Genus—Lithodomus, *Cuvier.*

14. *Lithodomus rugosus* (*?*), d'Orb. Cenomanian (Bed 10), Dunscombe. Mr. Meÿer's Collection. *a*, left valve; *b*, dorsal. (P. 105.)

CRETACEOUS LAMELLIBRANCHIA

PLATE XVIII.

Genus—Septifer, *Récluz.*

Figs.

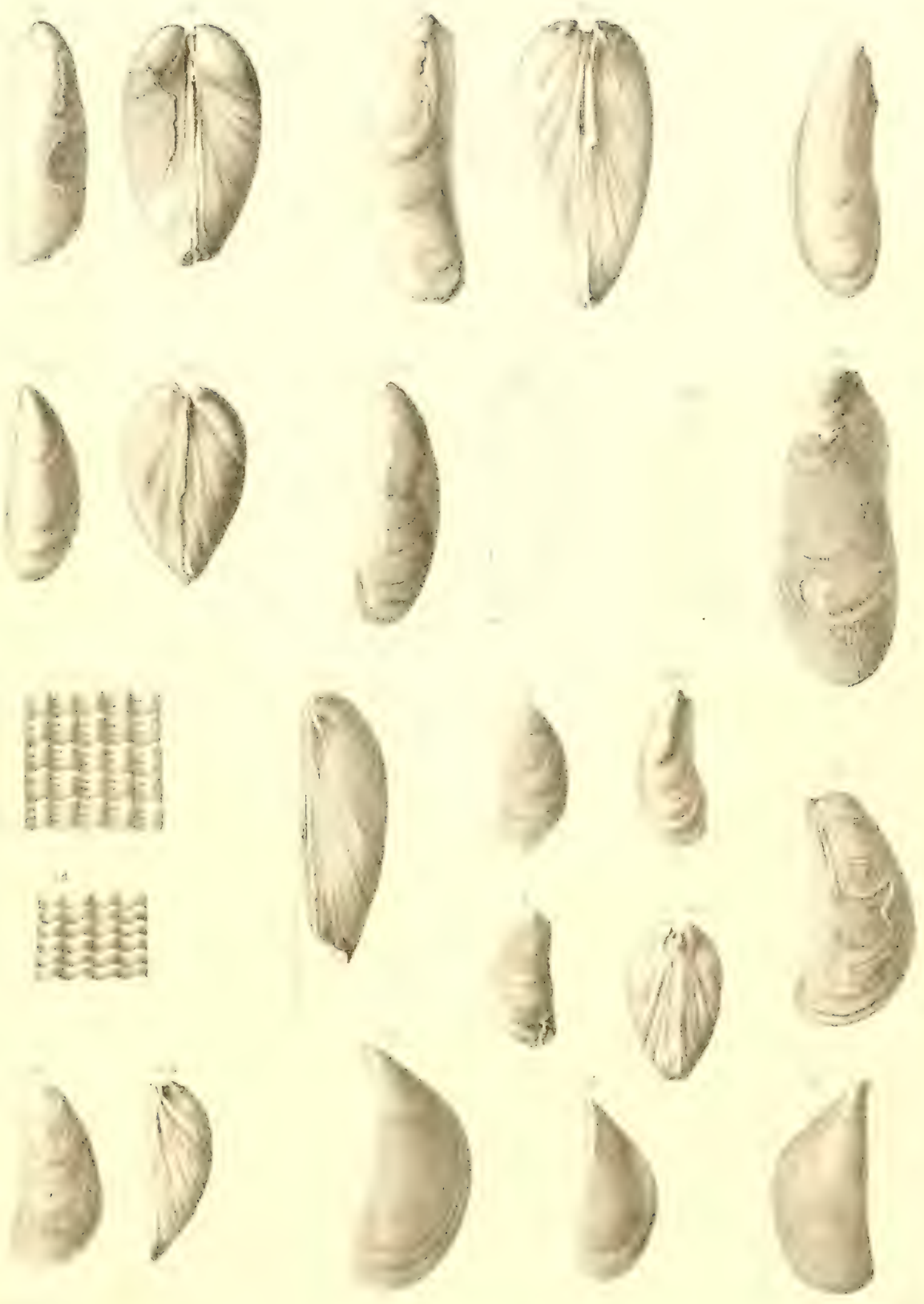
1—12. *S. lineatus* (Sow.). (P. 106.)

1. Hythe Beds, Lympne. Museum of Practical Geology, No. 6595. *a*, left valve; *b*, dorsal.
2. Same locality, &c., No. 6595. *a*, right; *b*, antero-ventral.
3. Hythe Beds, Hythe. Museum of the Geological Society. Right valve.
4. Hythe Beds, Lympne. Museum of Practical Geology, No. 6595. *a*, left valve; *b*, antero-ventral.
5. Chalk Marl, Chardstock. Museum of Practical Geology, No. 6596. *a*, left valve; *b*, antero-ventral outline.
6. Cenomanian (Bed 12), Kempstone Rocks (Sidmouth). Museum of Practical Geology, No. 6773. *a*, antero-ventral outline; *b*, right valve × 1½; *c*, ornamentation near the centre of the valve × 12; *d*, ornamentation near the posterior margin × 12.
7. Cenomanian (Bed 12), Axmouth. Mr. Meÿer's Collection. Antero-ventral of left valve.
8. Cenomanian (Bed 12), Dunscombe. Mr. Meÿer's Collection. Left valve.
9. Chalk Rock (*Reussianum* zone), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. Right valve. For figures of a larger example from this zone see 'Quart. Journ. Geol. Soc.,' vol. liii, 1897, pl. xxvii, figs. 11, 12.
10. Chalk Rock, Dullingham. Woodwardian Museum. Internal mould. *a*, right valve; *b*, antero-ventral.
11. Chalk Rock, Winchester. Mr. R. M. Brydone's Collection. *a*, left valve; *b*, antero-ventral. (Figured 'Quart. Journ. Geol. Soc.,' vol. liii, 1897, pl. xxvii, figs. 9, 10.)
12. Flint gravel (derived from Upper Chalk), near Ventnor. Left valve, somewhat flattened by crushing.

Genus—Dreissensia, *van Beneden.*

13—15. *D. lanceolata* (Sow.). Crackers, Atherfield. (P. 110.)

13. Left valve. Wiltshire Collection.
14. Left valve. Woodwardian Museum.
15. Right valve. Woodwardian Museum.



F.A.Brock del.
A.T.Hancock lith.

CRETACEOUS LAMELLIBRANCHI

PLATE XIX.

Dreissensia (*continued*).

Figs.

1—11. *D. lanceolata* (Sow.). (P. 110.)

1—3. Crackers, Atherfield.

1. Leckenby Collection, Woodwardian Museum. *a*, left valve; *b*, ventral—showing opening for byssus.
2. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, ventral.
3. Leckenby Collection. Right valve.

4. *Perna*-bed, Atherfield. Wiltshire Collection, Woodwardian Museum. *a*, left valve; *b*, interior of same.
5. Upper Greensand, Shaftesbury. British Museum, No. 88,894. Left valve.

6—11. Greensand, Blackdown.

6. Wiltshire Collection, Woodwardian Museum. *a*, left valve; *b*, part near the umbo × 2; *c*, dorsal of both valves.
7. Wiltshire Collection. *a*, right valve; *b*, ventral; *c*, interior of same.
8. Bristol Museum. The type of *Mytilus prælongus*, Sowerby.
9, 10. Wiltshire Collection. Left valves.
11. Bristol Museum. One of the types of *Mytilus tridens*, Sowerby. *a*, right valve; *b*, antero-ventral.

Genus—Trigonia, *Bruguière.*

12. *T. dunscombensis*, Lyc. Cenomanian (Bed 11), Humble Point, Lyme Regis. Museum of Practical Geology (No. 6774). *a*, right valve; *b*, dorsal. (P. 78.)
13. *T. ornata*, d'Orb. Hythe Beds, Lympne. Museum of Practical Geology (No. 6771). Left valve. (P. 85.)
14. *T. crenulata*, Lam. Cenomanian (Bed 10), Dunscombe. Mr. Meÿer's Collection. Left valve. (P. 82.)

T.A.Brock del
A.T.Holhek lith.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA

PLATE XX.

Trigonia (*continued*).

Figs.

1, 2. *T. scapha*, Agassiz. (P. 73.)

1. Lower Greensand (probably Snettisham ironstone nodules), West Norfolk. The type of *T. hunstantonensis*, Seeley. Woodwardian Museum. Right valve.
2. Snettisham Clay, one third of a mile south-west of Snettisham Church. Museum of Practical Geology. Portion of left valve. Drawn from a wax cast of an external mould.

Genus—Myoconcha, *Sowerby.*

3. *M. cretacea*, d'Orb. Chloritic Marl, Maiden Bradley. Woodwardian Museum. *a*, right valve ; *b*, ornamentation of same × 3. (P. 114.)

Genus—Spondylus, *Linnæus.*

4. *S. Roemeri*, Desh. *Perna*-bed, Atherfield. Woodwardian Museum. *a*, left valve (umbo slightly restored) ; *b*, outline from the posterior end ; *c*, right valve ; *d*, ornamentation of left valve × 3. (P. 116.)

5—11. *S. gibbosus*, d'Orb. Cambridge Greensand (derived from the Upper Gault), Cambridge. Woodwardian Museum. (P. 117.)

5, 6 *a*. Left valves ; 6 *b*, anterior outline ; 6 *c*, ornament of left valve × 2.
7 *a*. Left valve ; *b*, posterior of both valves ; *c*, right valve.
8 *a*. Left valve ; *b*, part of same × 2.
9 *a*. Left valve ; *b*, anterior outline.
10. Left valve.
11. Posterior outline of a specimen with talon-like right valve.

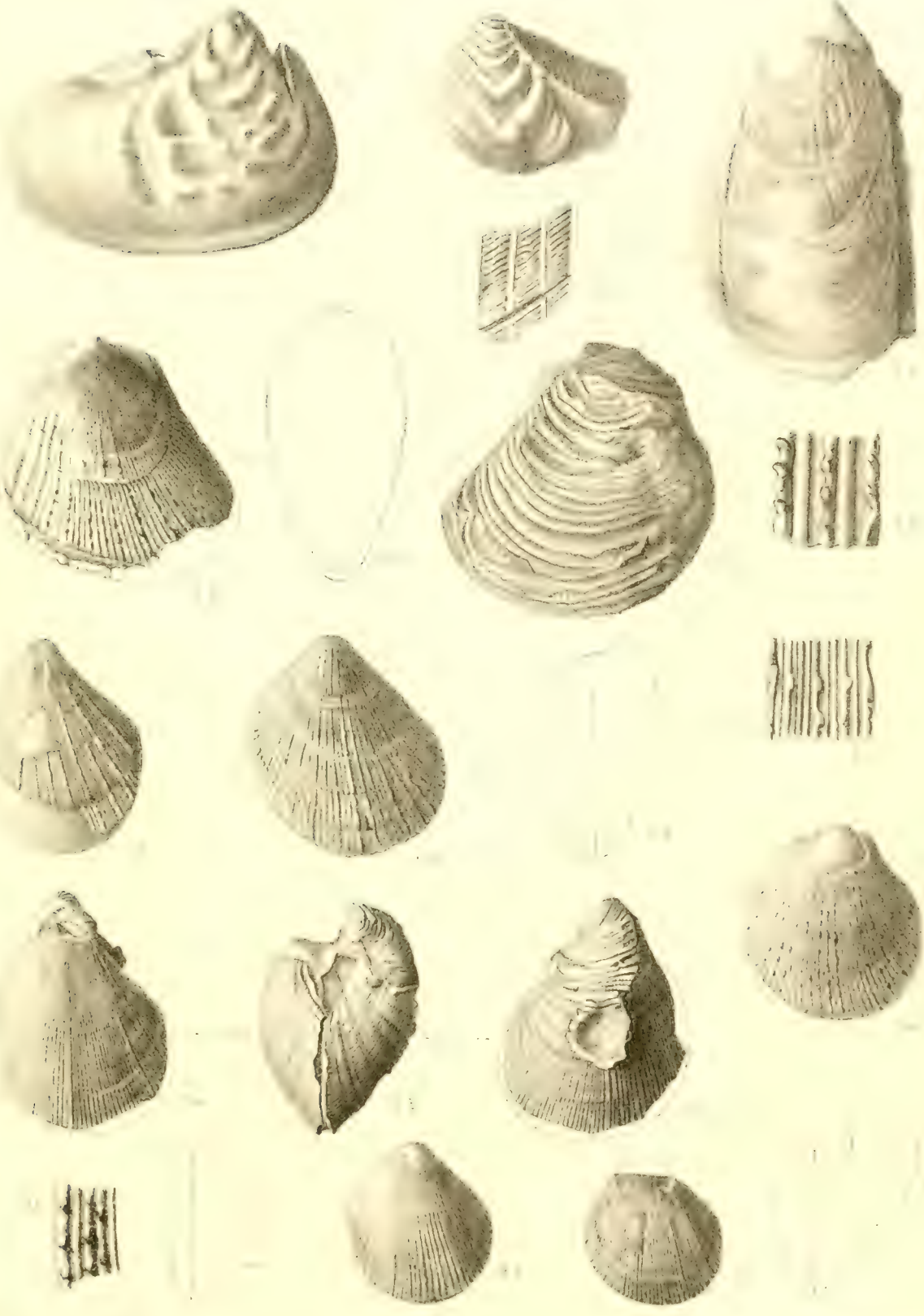


PLATE XXI.

Spondylus (*continued*).

Figs.

1—5. *S. striatus* (Sow.). Rye Hill Sand, Warminster. (P. 119.)

1. Museum of Practical Geology, No. 6836. *a*, left valve; *b*, anterior view.
2. Woodwardian Museum. Left valve.
3. British Museum. *a*, left valve and projecting umbo of right; *b*, posterior view.
4. Wiltshire Collection, Woodwardian Museum. Right valve with only a small surface of attachment.
5. York Museum. Left valve.

6, 7. *S. serratus*, Woods. (P. 124.)

6. Dr. Blackmore's Collection. *Uintacrinus*-band of *Marsupites* zone, Devizes Road, Salisbury. Left valve. *a*, outline, natural size; *b*, × 1½; *c*, ornament × 6.
7. British Museum. Upper Chalk. Left valve. *a*, outline, natural size; *b*, × 1½; *c*, ornament × 4.

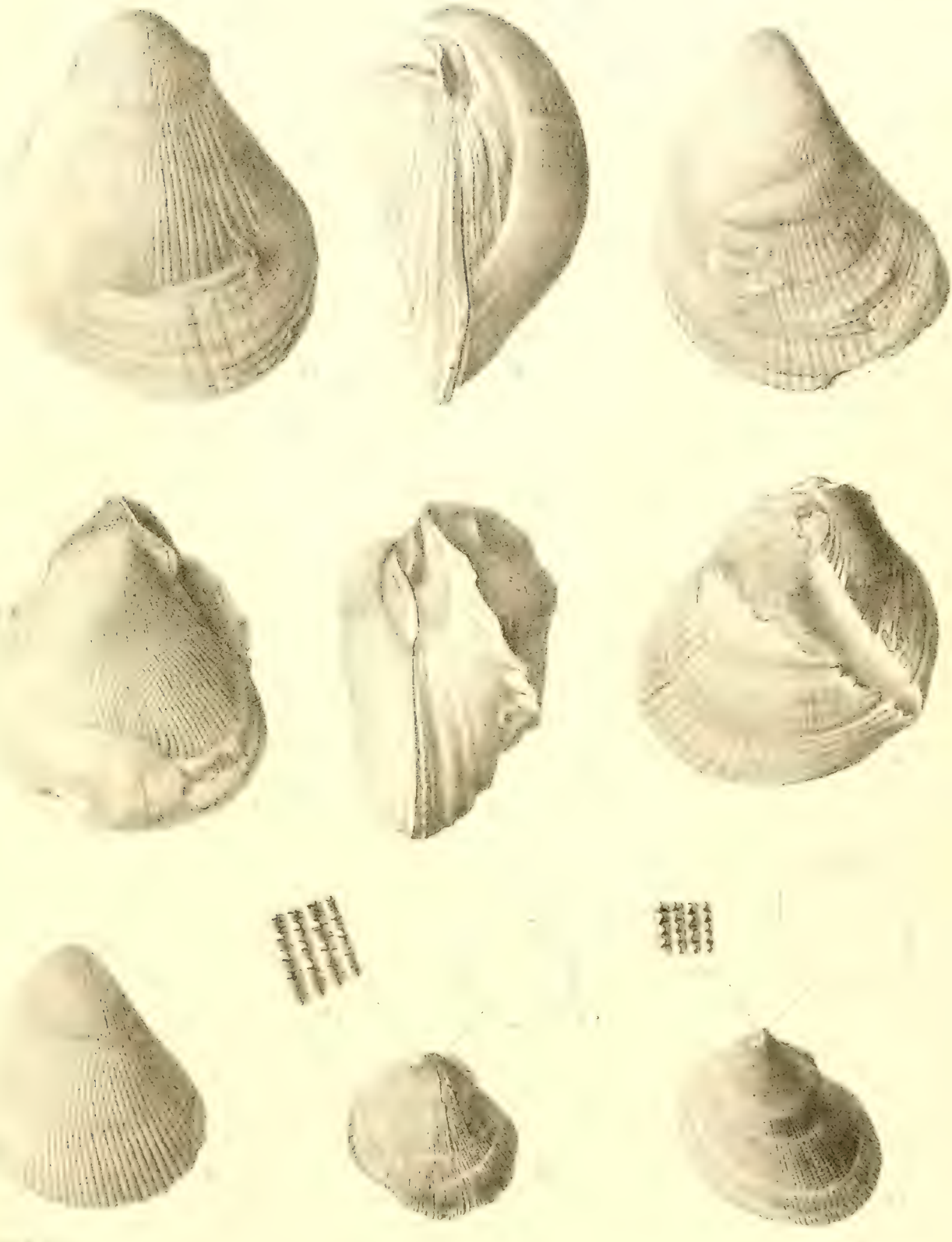


PLATE XXII.

Spondylus (*continued*).

Figs.

1—10. *S. latus* (Sowerby). (P. 121.)

1. Woodwardian Museum. The type of *S. æquicostatus*, Eth. Zone of *Holaster subglobosus*, Cherry Hinton. 1 *a*, left valve; 1 *b*, posterior view of the same.
2. Same collection, horizon, and locality. *a*, left valve; *b*, portion of same just ventral to centre of valve, × 4.
3. Woodwardian Museum. Lower Chalk, Fulbourn. Left valve.

4—9. Dr. Blackmore's Collection. Zone of *A. quadratus*. 4—8, East Harnham; 9, West Harnham, near Salisbury.

4. *a*, left valve, with part of right projecting; *b*, posterior view of both valves.
5. Right valve.
6. Left valve. Part near the umbo × 2.
7. Left valve × $1\frac{1}{2}$.
8. Left valve. *a*, × $1\frac{1}{2}$; *b*, posterior outline; *c*, ornamentation × 5.
9. Left valve, with umbo and marginal parts of right valve × $1\frac{1}{2}$.
10. Woodwardian Museum (Coll. Mr. W. Hill). Zone of *H. subglobosus*, cutting east of South Cave Station, Yorkshire. *a*, left valve; *b*, ornamentation × 4.

11—14. *S. Dutempleanus*, d'Orb. Zone of *A. quadratus*. Dr. Blackmore's Collection. 11—13, East Harnham. 14, Whaddon cutting. (P. 125.)

11. *a*, left valve × $1\frac{1}{2}$; *b*, ornamentation × 4.
12. *a*, left valve; *b*, ornamentation × 3.
13. Posterior view of both valves.
14. Right valve.

CRETACEOUS LAMELLIBRANCHIA

PLATE XXIII.

Spondylus (*continued*).

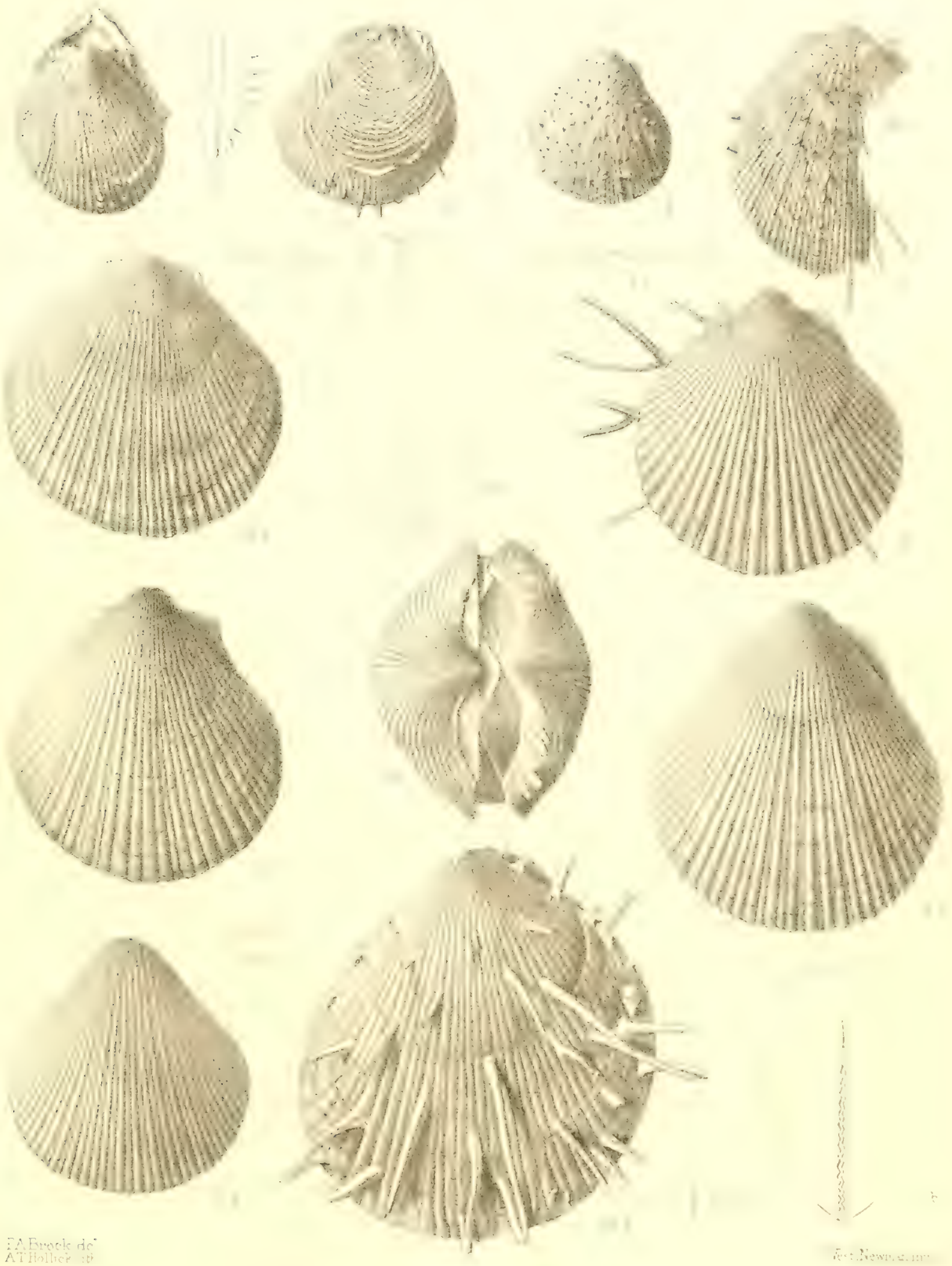
Figs.

1—5. *S. Dutempleanus*, d'Orb. (P. 125.)

1. *A. quadratus* zone, Whaddon cutting. Dr. Blackmore's Collection. Left valve and umbo of right × 1½.
2. *A. quadratus* zone, East Harnham, Salisbury. Dr. Blackmore's Collection. Anterior outline showing spines on left valve.
3. *B. mucronata* zone, Norwich. Norwich Museum. Right valve.
4. Chalk of Trimingham. Museum of Practical Geology (Coll. Mr. C. Reid). Left valve.
5. *B. mucronata* zone, Norwich. Norwich Museum. Part of left valve.

6—11. *S. spinosus* (Sow.). (P. 127.)

6. *T. gracilis* zone, Luton. Woodwardian Museum (Coll. Mr. W. Hill). *a*, left valve; *b*, anterior outline; *c*, section of ribs of left valve near the mid-ventral border × 2.
7. *T. gracilis* zone, East Knoyle. Woodwardian Museum (Coll. Mr. Jukes-Browne).
8. *H. planus* zone, Cheveley. Woodwardian Museum. Left valve, with spines projecting from the right valve.
9. Same zone, etc. *a*, left valve; *b*, dorsal view; *c*, section of ribs of left valve near the mid-ventral border × 2.
10. Same zone, etc. *a*, right valve (umbo slightly imperfect); *b*, section of ribs of right valve near the mid-ventral border × 2.
11. *M. cor-testudinarium* zone, Chatham. Woodwardian Museum (Coll. Mr. Jukes-Browne). *a*, left valve; *b*, anterior outline; *c*, ribs of left valve near the mid-ventral border × 2.



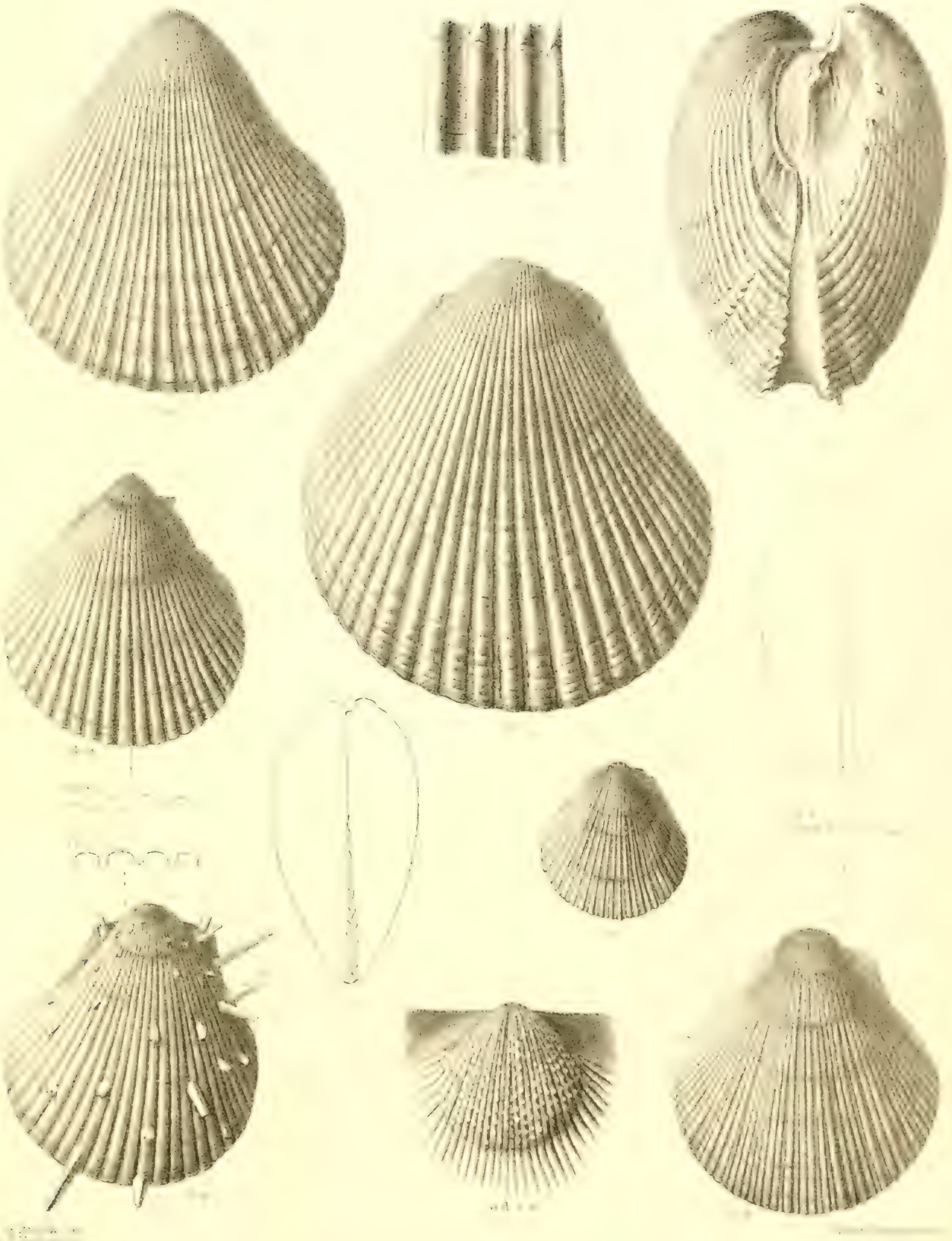
CRETACEOUS LAMELLIBRANCHIA

PLATE XXIV.

Spondylus spinosus (Sow.) (*continued*). (P. 127.)

Figs.

1. Upper part of *M. cor-anguinum* zone, Mitcheldever. Dr. Blackmore's Collection. *a*, left valve; *b*, posterior view.
2. *M. cor-anguinum* zone, Fletcher's pit, Gravesend. Woodwardian Museum. Small portion of left valve near the middle of the ventral border × 3.
3. *M. cor-anguinum* zone, Hungry Down, Blandford. Woodwardian Museum (Coll. Mr. Jukes-Browne). Left valve, umbo slightly imperfect.
4. Lower part of *Marsupites* zone, Witherington. Dr. Blackmore's Collection. *a*, left valve; *b*, section of ribs of the same near the mid-ventral border × 2.
5. Same horizon, locality, and collection. *a*, left valve; *b*, section of ribs of left valve near the mid-ventral border × 2; *c*, posterior outline.
6. *Marsupites* zone, Margate. Dr. Rowe's Collection. *a*, right valve; *b*, section of ribs of right valve near the mid-ventral border × 2; *c*, posterior outline; *d*, umbo of left valve × 5.
7. *A. quadratus* zone, West Harnham, Salisbury. Dr. Blackmore's Collection. Left valve.



LAMELLIBRANCHIA

PLATE XXV.

Genus—PLICATULA, *Lamarck*.

FIGS.

1—4. *P. placunea*, Lam. Hythe Beds, Lympne. Museum of Practical Geology, No. 6781. 1, 2, 4, right valves; 1 *b*, anterior outline; 3, left valve. (P. 134.)

5—12. *P. Carteroniana*, d'Orb. Lower Greensand, Upware. Right valves, except fig. 7 (left valve); 5 *b*, 6 *b*, anterior outlines. Figs. 6—9, Woodwardian Museum. Figs. 5, 10—12 in Mr. J. F. Walker's Collection. (P. 135.)

13—21. *P. gurgitis*, Pict. and Roux. Gault, Folkestone, except figs. 18, 21. (P. 137.)

13—15. Wiltshire Collection. Right valves; 13 *b*, left valve.
16, 17. York Museum. Right valves.
18. Woodwardian Museum. Gault, Cambridge. Right valve.
19. York Museum. Right valve.
20. Part of left valve of 19.
21. Woodwardian Museum. Cambridge Greensand (derived from the Gault).

22—25. *P. minuta*, Seel. (P. 138.)

22, 24. Woodwardian Museum. Cambridge Greensand.
23. Wiltshire Collection. Red Limestone, Speeton.
25. „ „ Red Limestone, Hunstanton. *a*, outline, natural size; *b*, × 3.

A T Hollick lith

CRETACEOUS LAMELLIBRANCHIA

PLATE XXVI.

Plicatula (*continued*).

Figs.

1—11. *P. inflata*, Sow. Woodwardian Museum, Cambridge. Right valves (except fig. 7). (P. 139.)

1—3, 5. Totternhoe Stone, Burwell.
4. Lower Chalk, Burwell.
6. Totternhoe Stone, Arlesey.
7. ,, ,, Reach. Left valve.
8. ,, ,, Burwell.
9. Lower Chalk, Burwell.
10. Chalk Marl, Haslingfield.
11. *H. subglobosus* zone, Cherry Hinton.

12—18. *P. Barroisi*, Peron. Right valves, except figs. 13, 14. (P. 141.)

12. *H. planus* zone, Dover. Dr. Rowe's Collection. *a*, natural size; *b*, × 4.
13. *H. planus* zone, Twyford. Woodwardian Museum. Left valve, *a*, natural size; *b*, × 4.
14. Top of *M. cor-anguinum* zone, North Foreland. Dr. Rowe's Collection. Left valve, *a*, natural size; *b*, × 4.
15. *H. planus* zone, Dover. Dr. Rowe's Collection, *a*, natural size; *b*, × 4.
16. *Uintacrinus*-band, Kingsgate, Margate. Dr. Rowe's Collection. *a*, natural size; *b*, × 4.
17. *H. planus* zone, Twyford. Woodwardian Museum. *a*, natural size; *b*, × 4.
18. Chalk Rock, near Winchester. Mr. R. M. Brydone's Collection. *a*, natural size; *b*, × 4.

19—22. *P. sigillina*, Woodw. (P. 143.)

19. *B. mucronata* zone, Hartford Bridge, Norwich. Woodwardian Museum. *a*, interior of right valve; *b*, central part of same × 2.
20. Top of *M. cor-testudinarium* zone, Chatham. Dr. Rowe's Collection. Left valve.
21. Same horizon, etc. Left valve × 2.
22. *M. cor-testudinarium* zone, Chatham. Museum of Practical Geology, No. 179. Left valve. *a*, natural size; *b*, × 2.

PLATE XXVII.

Genus—PECTEN, *Müller*.

Pecten (*Syncyclonema*) *orbicularis*, Sow. (P. 145.)

(All in the Woodwardian Museum, except fig. 4.)

FIGS.

1, 2. Tealby Limestone, North Willingham. Right valves.

3. Gault, Folkestone, Wiltshire Collection. Right valve.

4. Var. *haldonensis*, Woods. Upper Greensand, Kingskerswell. Museum of Practical Geology, No. 991. Right valve.

5. Chloritic Marl, Maiden Bradley. Right valve.

6—9. Upper Greensand, Ventnor. 6 *a*, right valve (ears partly drawn from another specimen); 6 *b*, antero-ventral portion of the same × 3. 7 *a*, right valve (margins of ears slightly restored); 7 *b*, posterior portion of the same × 3; 7 *c*, left valve of the same specimen. 8, right valve. 9 *a*, right valve; 9 *b*, postero-ventral portion of the same × 3. 6, 7, Leckenby Collection. 8, 9, Wiltshire Collection.

10—13. Chalk Marl, Burwell. 10 *a*, left valve; 10 *b*, portion of the same near the ventral margin × 10 (on other parts of the valve the fine concentric ridges are closer together). 11—13, right valves.

14. Totternhoe Stone, Burwell. Part of interior of right valve × 2.

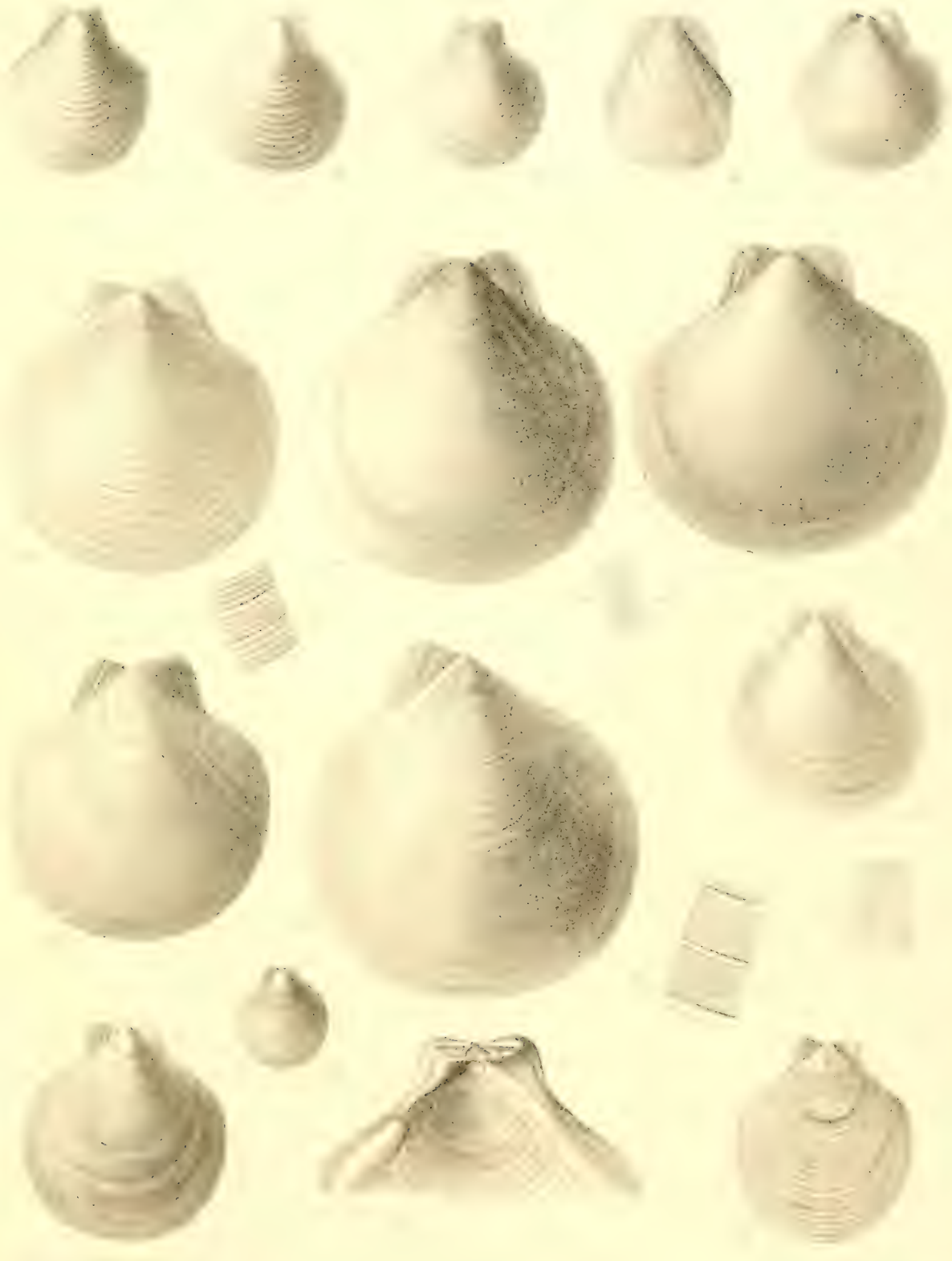


PLATE XXVIII.

PECTEN (*continued*).

P. (*Camptonectes*) *cinctus*, Sow. Claxby Ironstone (zone of *B. lateralis*) of Claxby. Woodwardian Museum. (P. 152.)

FIGS.

1 *a*. Right valve × $\frac{1}{2}$. 1 *b*, portion of the same, natural size.

2 *a*. Left valve of another specimen × $\frac{2}{3}$. 2 *b*, portion of the same, natural size.

3. Portion of left valve with the concentric laminæ well preserved × 2.

(The ears in figs. 1 *a*, 2 *a*, have been partly completed from other specimens.)

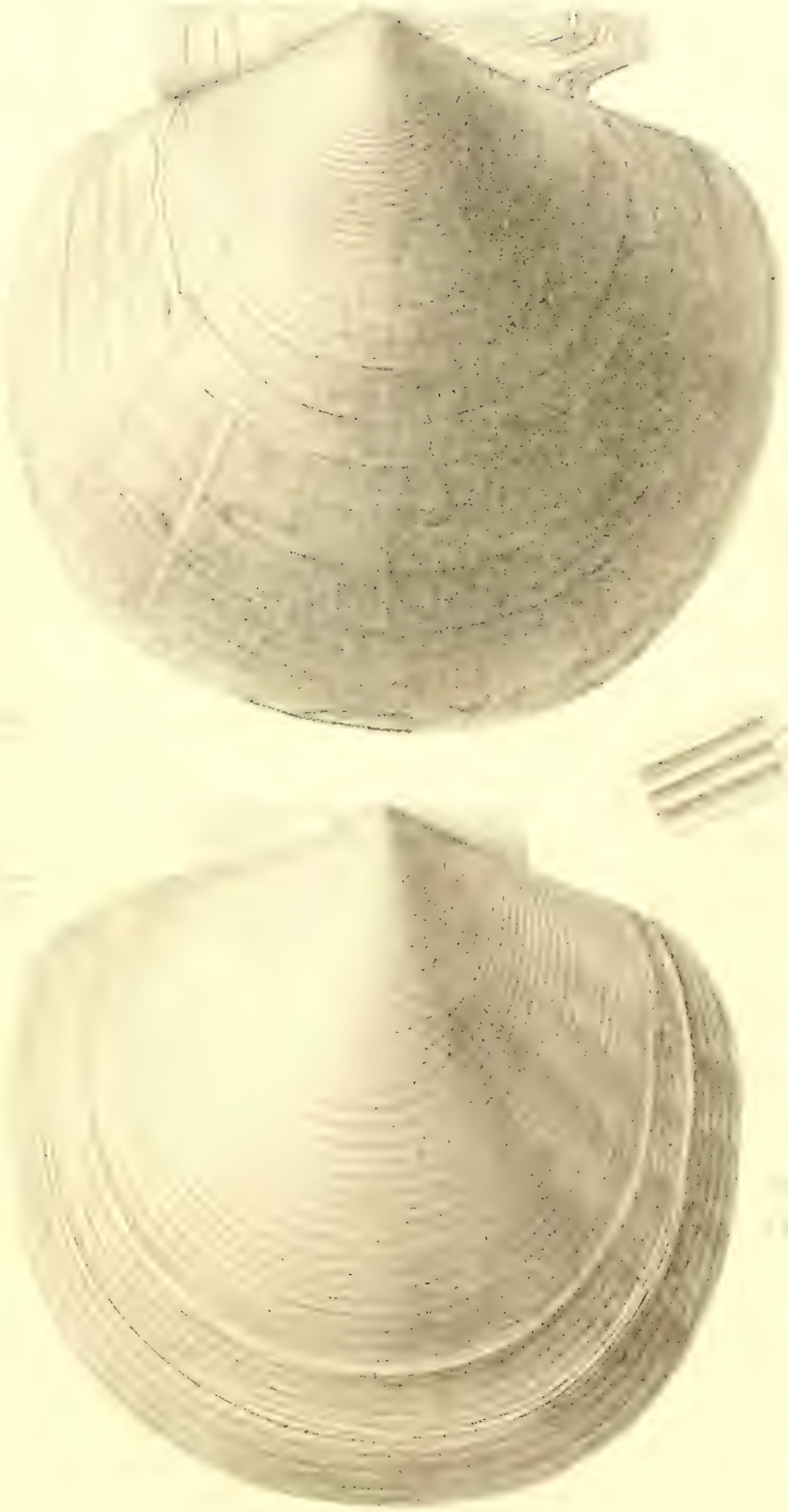


PLATE XXIX.

Pecten (*continued*).

Figs.

1—3. *P.* (*Camptonectes*) *Cottaldinus*, d'Orb. Leckenby Collection, Woodwardian Museum. (P. 156.)

1. Lower Greensand, Whale Chine. Right valve.
2. *Perna*-bed, Atherfield. *a*, left valve; *b*, part of the same above the middle of the valve × 3.
3. *Perna*-bed, Atherfield. Left valve. *a*, part near the middle of the dorsal third × 3; *b*, part of the anterior ear × 4.

4—6. *P.* (*Camptonectes*) *striato-punctatus*, Röm. (P. 157.)

4. Speeton Clay (D 1). Mr. Lamplugh's Collection. *a*, part of left valve; *b*, part of same × 3.
5. Same horizon, etc. Anterior left ear × 3.
6. Claxby Ironstone, Benniworth Haven. Woodwardian Museum. Part of left valve.

7. *P.* (*Camptonectes*) *curvatus*, Gein. Greensand, Great Haldon. Museum of Practical Geology, No. R 478*a*. Left valve. *a*, natural size; *b*, same × 3. (P. 159.)

8. *P.* (*Camptonectes*) *dubrisiensis*, Woods. Chalk Marl, Dover. British Museum, No. 38243. *a*, right valve; *b*, left valve; *c*, anterior ear of *b* × 2. (P. 162.)

T.A.Brock del
A.T.Hollick lith

PLATE XXX.

PECTEN (*continued*).

FIGS.

1, 2. *P.* (*Camptonectes?*) *gaultinus*, Woods. Gault. Woodwardian Museum. 1 *a*, right valve, Folkestone, × 1½; 1 *b*, portion of the same near the postero-dorsal margin × 6. 2, left valve, Black Ven, × 2. (P. 163.)

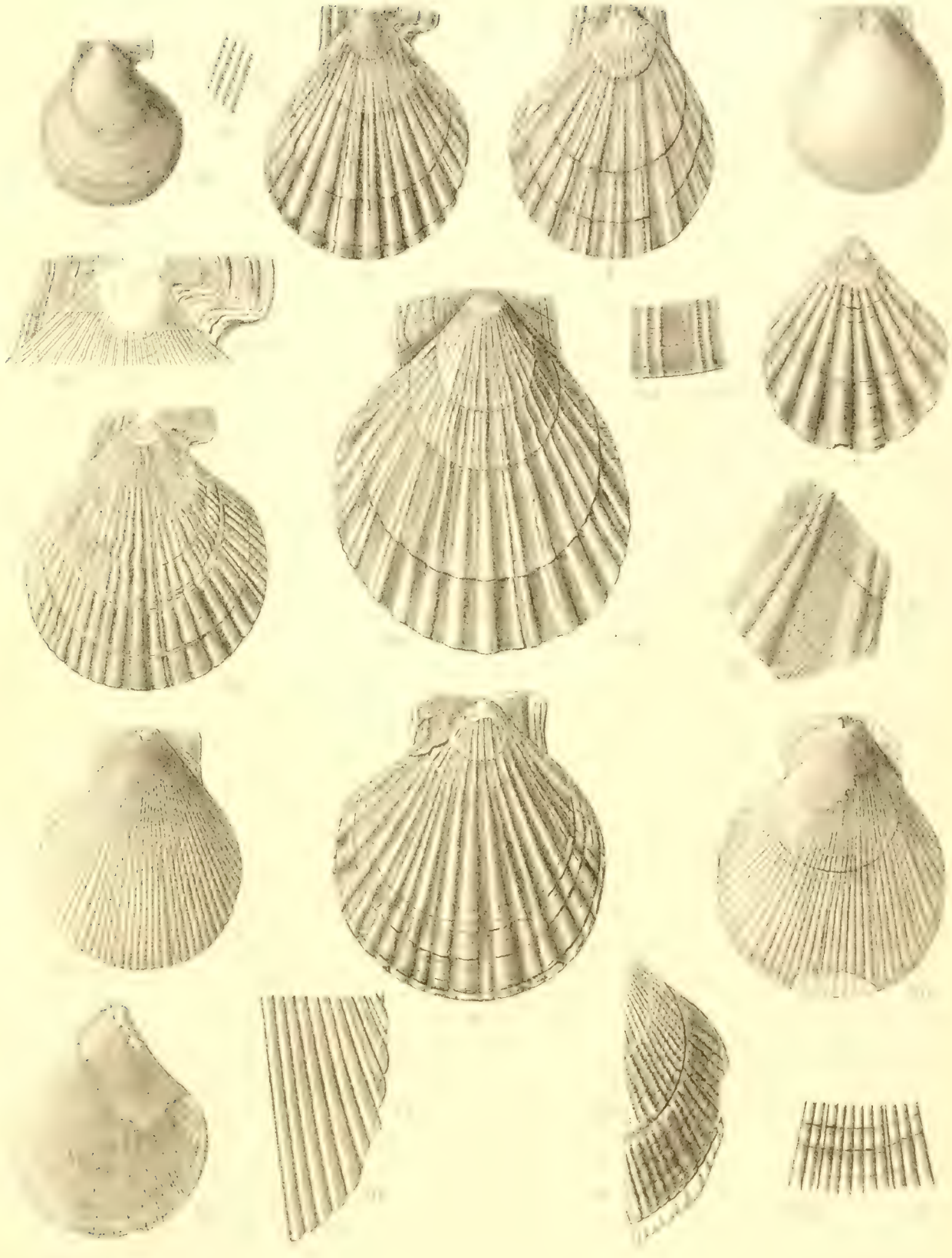
3—8. *P.* (*Chlamys*) *fissicosta*, Eth. Woodwardian Museum. (P. 163.)

3—6. Totternhoe Stone, Burwell.
7. „ „ Arlesey.
8. „ „ Cherry Hinton.

3, right valve (type). 4, left valve (type). 5 *a*, right valve; 5 *b*, part of the same specimen × 2. 6 *a*, left valve × 1½; 6 *b*, part of the same near the antero-ventral border × 3; 6 *c*, another part near the middle of the valve × 3. 7, right valve of a variety with few ribs. 8, left valve, crushed near the umbo.

9—12. *P.* (*Chlamys*) *Puzosianus*, Math. Woodwardian Museum. (P. 165.)

9. Cenomanian, north of Beer Head. *a*, left valve; *b*, postero-ventral part of the same × 2.
10. Cenomanian, Wilmington. *a*, left valve; *b*, part of the same near the centre × 2.
11. Same locality. Right valve.
12. Top of Chloritic Marl, Melbury, North Dorset. Anterior part of right valve with the ornamentation well preserved × 2.



CRETACEOUS LAMELLIBRANCHIA

PLATE XXXI.

Pecten (*continued*).

Figs.

1, 2. *P. (Chlamys) britannicus*, Woods. (P. 167.)

1. Dr. Blackmore's Collection. Upper part of *M. cor-anguinum* zone, Stratford, near Salisbury. *a*, part of valve; *b*, same × 4.
2. Mr. G. E. Dibley's Collection. *M. cor-anguinum* zone, Haling Pit, South Croydon. *a*, left valve; *b*, part of the same × 3.

3—6. *P. (Chlamys) Milleri*, Sow. Greensand, Blackdown. Woodwardian Museum. (P. 168.)

3. Meÿer Collection. *a*, left valve; *b*, part of the same near the umbo × 6.
4. Wiltshire Collection. *a*, right valve × 2. The anterior ear is drawn from another specimen in the same collection.
5. Wiltshire Collection. Right valve. Ornamentation just above the middle of the valve × 6.
6. Meÿer Collection. *a*, left valve; *b*, postero-ventral part of the same × 3.

7—9. *P. (Chlamys) subacutus*, Lam. (P. 169.)

7, 9. Meÿer Collection. Bed 11 (Cenomanian), Dunscombe. 7 *a*, right valve; 7 *b*, part of same × 3. 9, ribs of another right valve near the middle of the valve × 3.

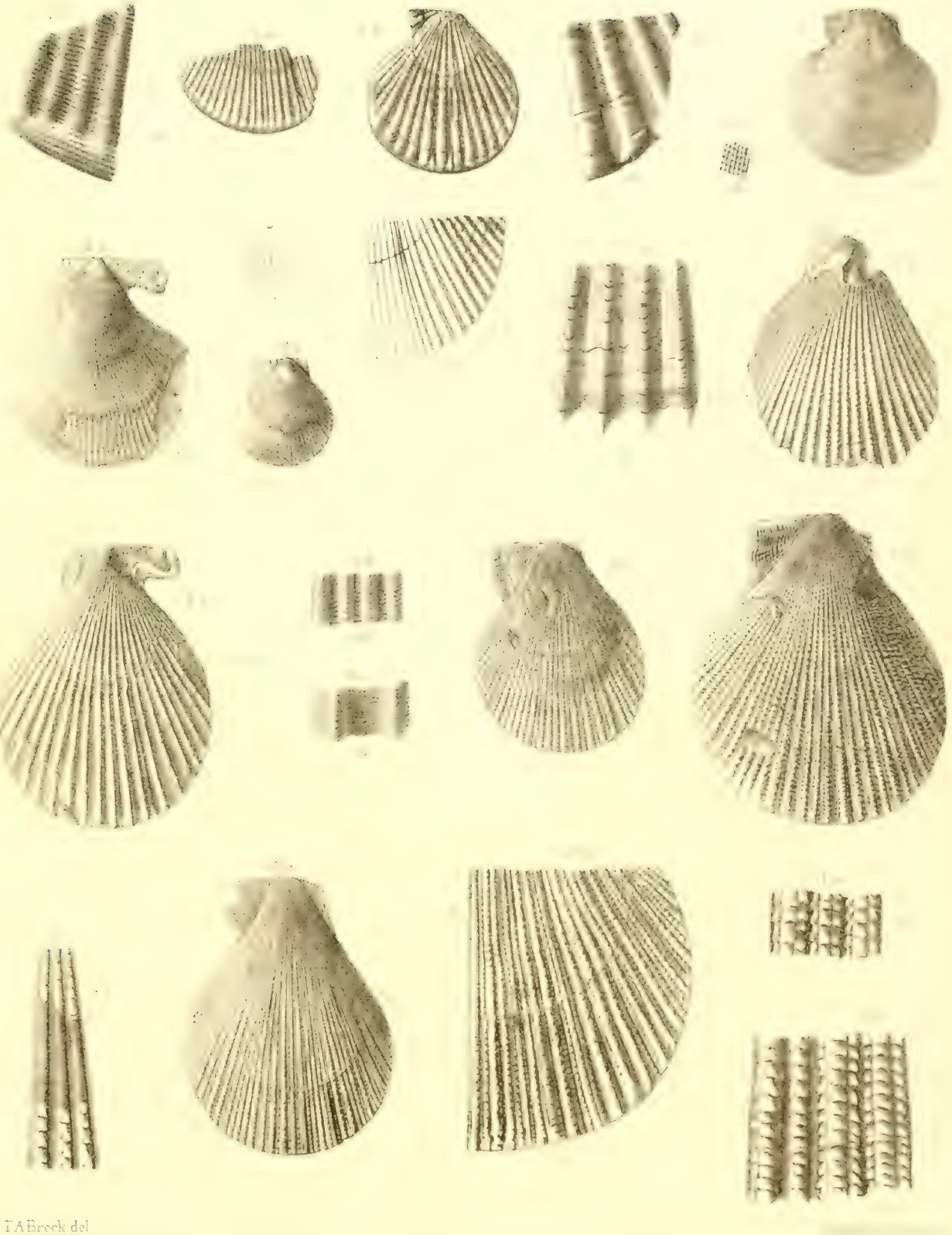
8. Museum of Practical Geology, No. 6683. Greensand, Haldon. *a*, right valve; *b*, part of same in the middle of the dorsal third × 4; *c*, part near middle of ventral border × 4.

10—13. *P. (Chlamys) elongatus*, Lam. Woodwardian Museum. (P. 170.)

10, 11. Wiltshire Collection. Gault, Folkestone. 10, left valve. 11 *a*, left valve; 11 *b*, part of same × 3.

12. Wiltshire Collection. Chalk Marl, Ventnor. *a*, left valve; *b*, postero-ventral part of same × 2.

13. Totternhoe Stone, Arlesey. Right valve. Ribs near the middle of the ventral border × 4.



T.A.Brock del.
A.T.Hallock lith.

CRETACEOUS LAMELLIBRANCHI

PLATE XXXII.

PECTEN (*continued*).

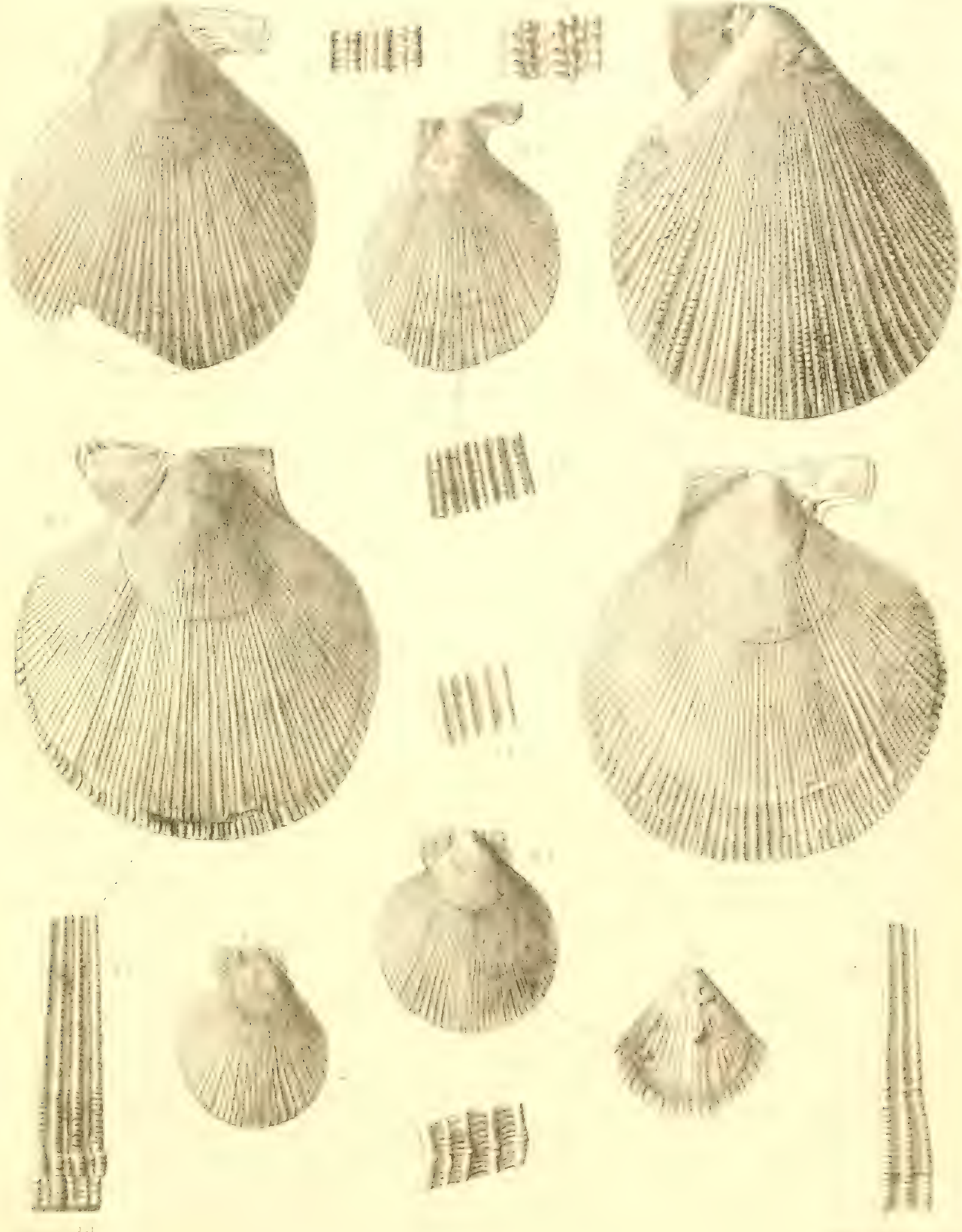
FIGS.

1—3. *P.* (*Chlamys*) *elongatus*, Lam. (P. 170.)

1. Grey Chalk, Dover. York Museum. *a*, right valve; *b*, portion of the same near the middle of the valve × 3.
2. Lower Chalk, Burwell. Woodwardian Museum. *a*, left valve; *b*, part of the same near the middle of the valve × 3.
3. Same horizon, etc. *a*, right valve; *b*, part of same below the middle of the valve × 3. (The anterior ear is displaced.)

4—6. *P.* (*Chlamys*) *cretosus*, Defr. *A. quadratus* zone, East Harnham. Dr. Blackmore's Collection. (P. 174.)

4 *a*, left valve × 1½.
4 *b*, mid-ventral ribs of 4 *a* × 3.
4 *c*, right valve of the same specimen × 1½.
4 *d*, mid-ventral ribs of 4 *c* × 3.
5 *a*, left valve.
5 *b*, part of 5 *a* posterior to the middle of the ventral border × 4.
6 *a*, left valve.
6 *b*, umbo of 6 *a* × 3.
6 *c*, part of 6 *a* near the mid-ventral border × 4.



del
A.T.Holbrook lith.

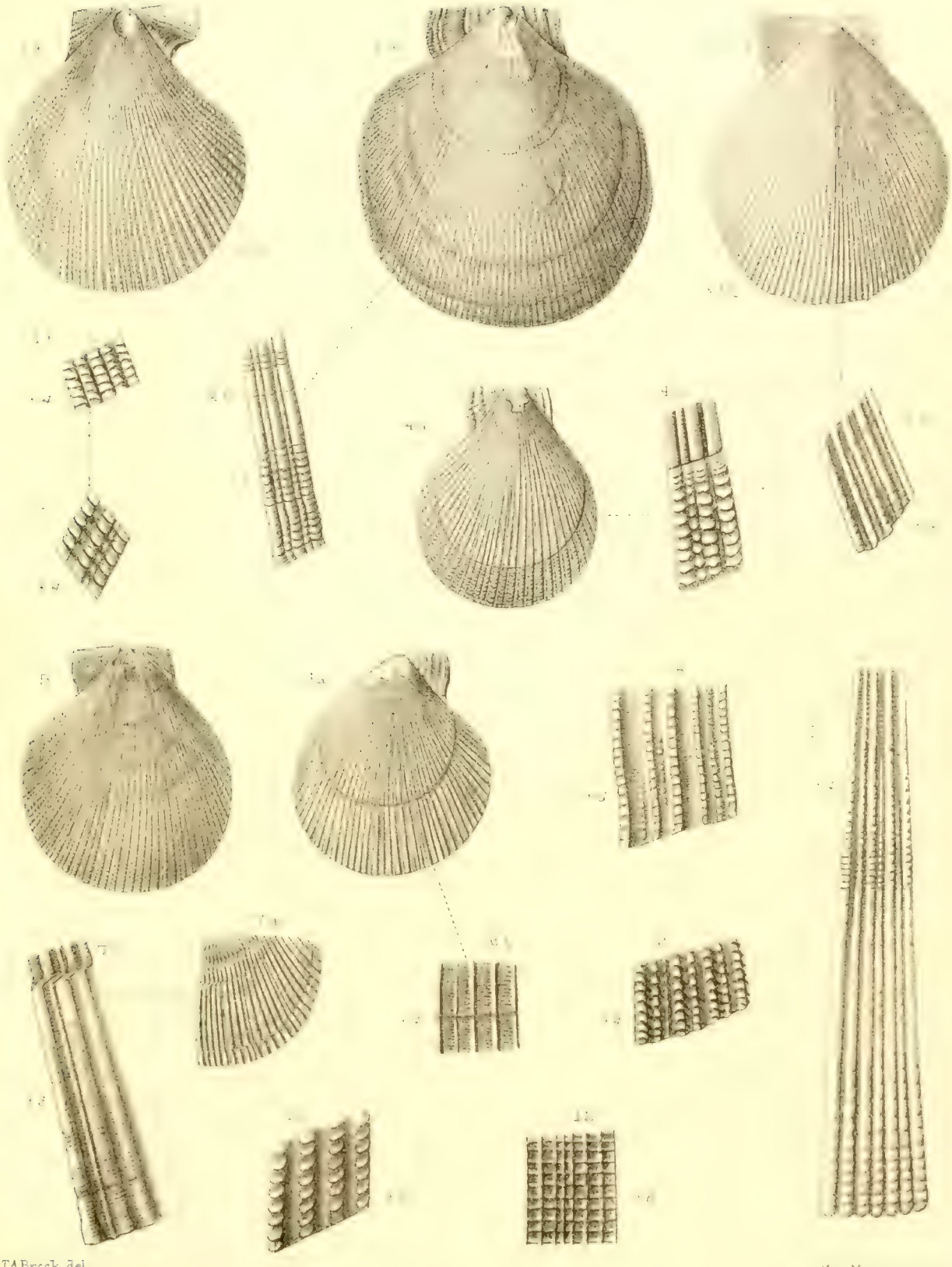
PLATE XXXIII.

Pecten (*continued*).

Pecten (*Chlamys*) *cretosus*, Defr. Upper Chalk. (P. 174.)

Figs.

1. *A. quadratus* zone, East Harnham. Dr. Blackmore's Collection. *a*, right valve × 1½; *b*, part at antero-ventral edge × 4; *c*, antero-ventral part of left valve of the same specimen × 4.
2. Same horizon, etc. *a*, left valve; *b*, part just behind the mid-ventral edge × 3.
3. Same horizon, etc. *a*, left valve × 1½; *b*, part at postero-ventral margin × 4. Fine concentric ridges cover almost the entire shell, but are not shown in the figure. Near the umbo the radial ribs are spiny.
4. *M. cor-anguinum* zone, Porton. Dr. Blackmore's Collection. *a*, left valve; *b*, part just behind the mid-ventral margin × 3.
5. *Marsupites* zone, Witherington. Dr. Blackmore's Collection. Left valve.
6. *M. cor-anguinum* zone, Gravesend. Mr. G. E. Dibley's Collection. *a*, right valve, with interior of anterior *left* ear; *b*, part of mid-ventral third × 4.
7. Upper Chalk, Bromley. Wiltshire Collection. Right valve of specimen with coarse ribs. *a*, antero-ventral part; *b*, portion of same part × 3.
8. Same horizon, etc. Part of mid-ventral third of left valve × 6.
9. *B. mucronata* zone, Norwich. Norwich Museum, No. 2056. Part of left valve near the middle of the ventral edge × 4.
10. *A. quadratus* zone, East Harnham. Dr. Blackmore's Collection. Part at the mid-ventral edge × 4.
11. Upper Chalk, Charlton. Wiltshire Collection. Right valve of a specimen with the scaly spines large and well-preserved. Part near the ventral edge × 6.
12. Upper Chalk, Trimingham. Mr. R. M. Brydone's Collection. Right valve. Form with numerous slender ribs. Portion at the dorsal third × 6.



TA Brock del.
A T Holluck lith

West, Newman imp

CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXIV.

Pecten (*continued*).

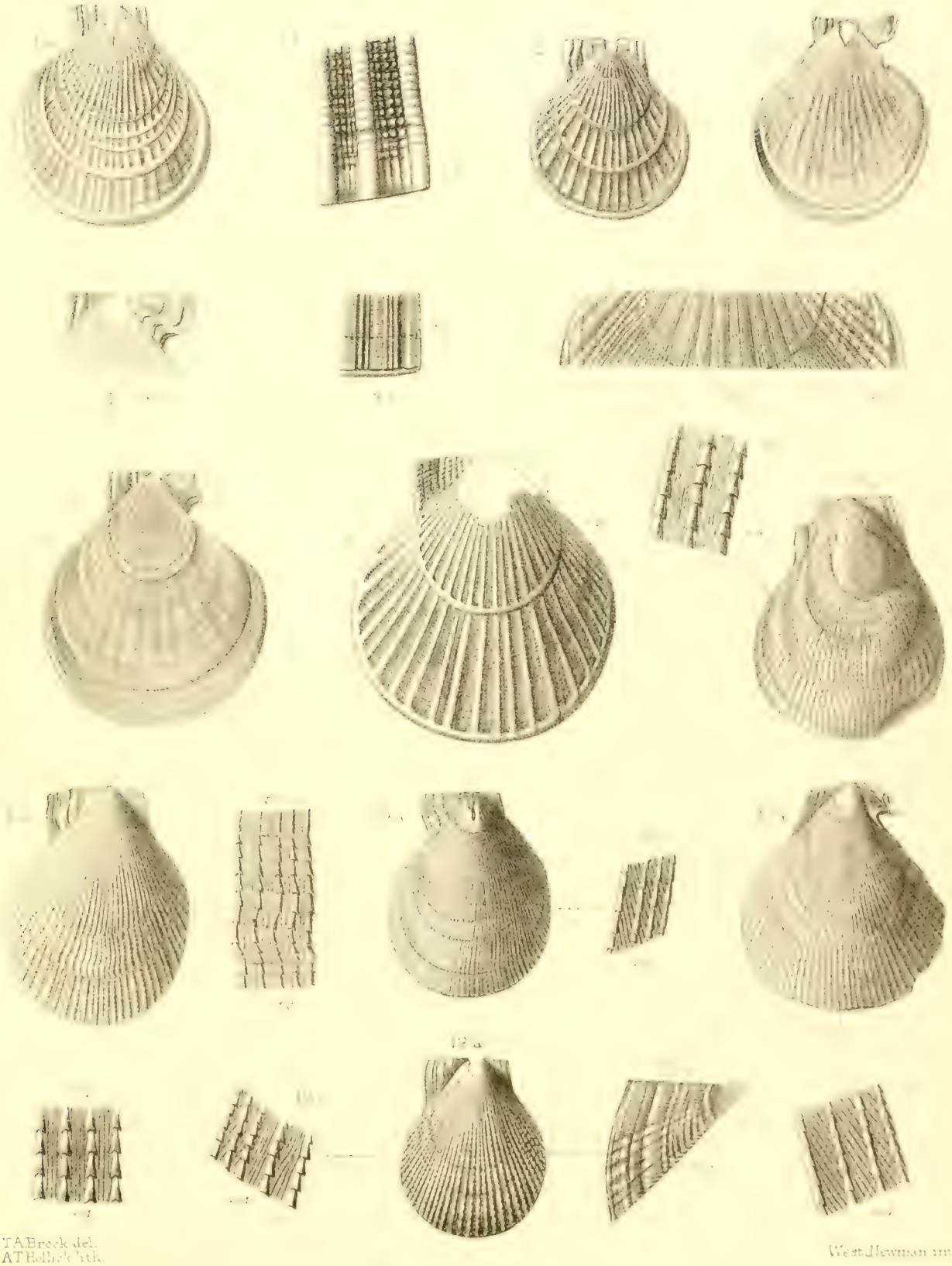
Figs.

1—6. *P.* (*Chlamys*) *Mantellianus*, d'Orb. Upper Chalk (*B. mucronata* zone), Norwich. Norwich Museum (except fig. 3). (P. 179.)

1. No. 2093. *a*, left valve; *b*, part near mid-ventral edge × 6.
2. No. 2053. Left valve.
3. Woodwardian Museum. Right valve. *a*, natural size; *b*, middle part × 2; *c*, portion near the centre × 5.
4. No. 2055. Right valve. Part near the umbo × 2.
5. No. 2055 (another specimen). Right valve.
6. No. 2053. Left valve × 2.

7—12. *P.* (*Chlamys*) *Robinaldinus*, d'Orb. *Perna*-bed. Atherfield. Woodwardian Museum. (P. 181.)

7. Leckenby Collection. *a*, left valve; *b*, part near the margin just in front of the mid-ventral part × 4.
8. Leckenby Collection. *a*, left valve; *b*, part of the middle of the valve between the two strong growth-lines × 3.
9. Leckenby Collection. *a*, left valve; *b*, part near the mid-ventral edge × 3.
10. *a*, right valve; *b*, part near the antero-ventral margin × 4.
11. Left valve; middle of ventral third × 4.
12. Wiltshire Collection. *a*, left valve; *b*, part near the mid-ventral margin × 4; *c*, anterior ear × 3.



T.A.Brock del.
A.T.Bell lith.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA

PLATE XXXV.

Pecten (*continued*).

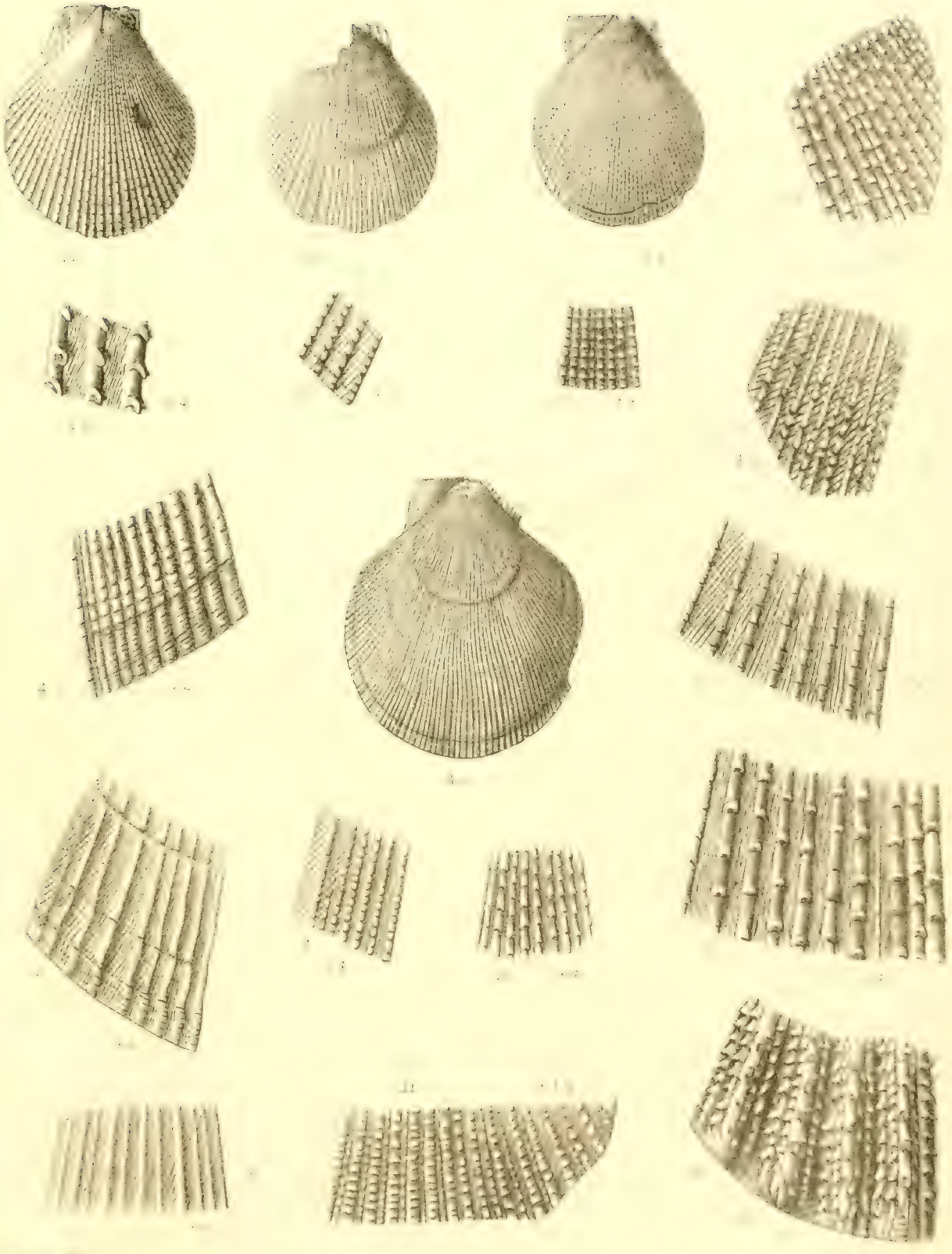
Figs.

1—10. *P.* (*Chlamys*) *Robinaldinus*, d'Orb. Upper Greensand (except figs. 5, 6, 8). (P. 181.)

1. Warminster. British Museum, No. 67734. *a*, left valve; *b*, antero-ventral part of the same × 4.
2. Warminster. Woodwardian Museum. *a*, left valve; *b*, antero-ventral part × 4; *c*, part near the umbo × 4.
3. Ventnor. Wiltshire Collection. *a*, left valve; *b*, posterior part × 4.
4. Warminster. Museum of Practical Geology, No. 7418. *a*, right valve; *b*, part just in front of the mid-ventral edge × 4; *c*, anterior part of left valve of same specimen × 4.
5. Chloritic Marl, Maiden Bradley. Mr. J. Scanes' Collection. ? Left valve; antero-ventral part × 4.
6. Same horizon, etc. Left valve; part at the antero-ventral margin × 4.
7. Ventnor. Wiltshire Collection. Left valve; mid-ventral part × 4.
8. Cenomanian (Bed 11), Beer Head. Meÿer Collection. ? Left valve; antero-ventral part × 4.
9. Warminster. Bristol Museum. Right valve; postero-ventral part × 4.
10. Warminster. Museum of Practical Geology, No. 7407. Middle part of left valve × 4.

11. *P.* (*Chlamys*) *Stutchburianus*, Sow. Greensand, Blackdown. The Type. Bristol Museum. Ventral part × $1\frac{1}{2}$. (P. 185.)

12. *P.* (*Æquipecten*) *asper*, Lam. Upper Greensand (Chert Beds), Baycliffe Quarry, Wiltshire. Mr. J. Scanes' Collection. Left valve; part just in front of mid-ventral margin × 4. (P. 186.)



CRETACEOUS LAMELLIBRANCHIA

PLATE XXXVI.

PECTEN (*continued*).

FIGS.

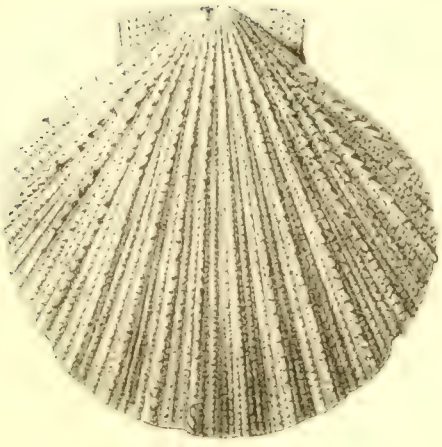
1—4. *P.* (*Æquipecten*) *asper*, Lam. Upper Greensand, Warminster. (P. 186.)

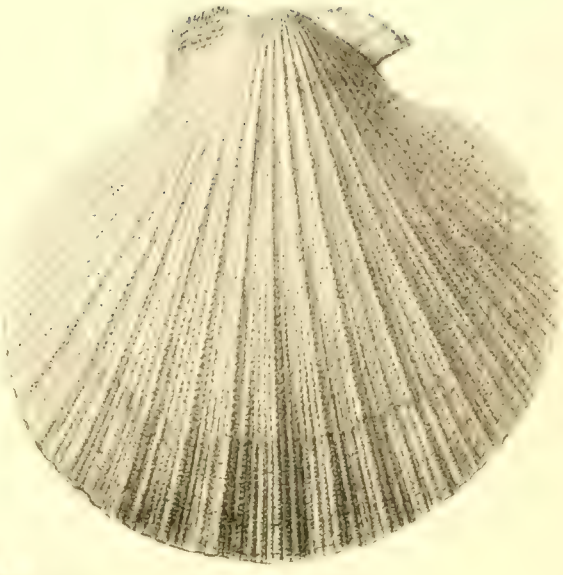
1. Woodwardian Museum. *a*, left valve (the anterior ear is drawn from another specimen); *b*, ventral part × 3.
2. York Museum. Right valve.
3. Woodwardian Museum. A form with few ribs. ? Right valve.
4. Woodwardian Museum. Right valve; mid-ventral part × 3.

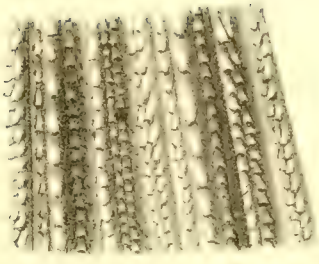
5—7. *P.* (*Æquipecten*) *pexatus*, Woods. (P. 190.)

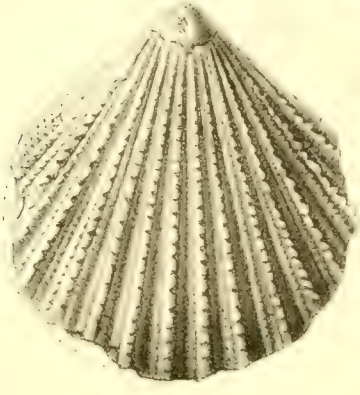
5. Upper Chalk, near Salisbury. Dr. Blackmore's Collection. *a*, × 2; *b*, ventral part × 5.
6. *H. planus* zone, Cheveley, near Newmarket. Woodwardian Museum. × 2.
7. *A. quadratus* zone, East Harnham. Dr. Blackmore's Collection. *a*, outline, natural size; *b*, part of same × 5.

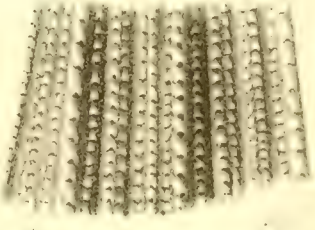
8. *P.* (*Æquipecten*), sp. *A. quadratus* zone, East Harnham. Dr. Blackmore's Collection. *a*, × $1\frac{1}{2}$; *b*, part of same × 4. (P. 191.)

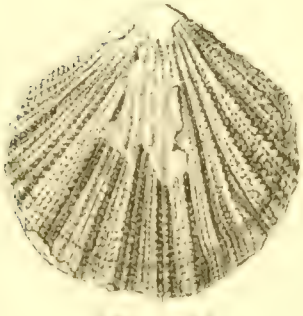


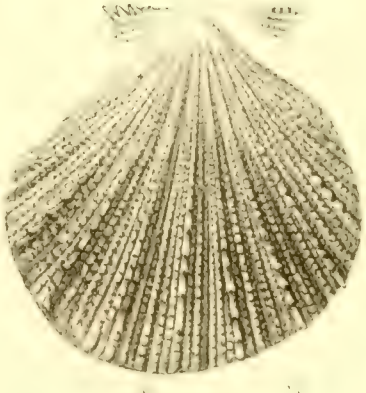


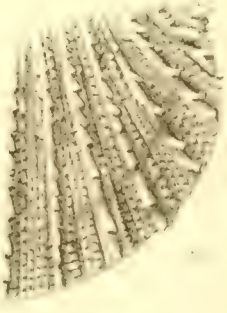


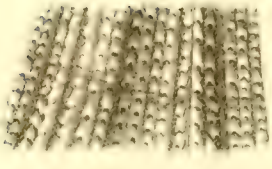


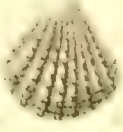












A.T.Hollick del et lith

CRETACEOUS LAMELLIBRANCHI

PLATE XXXVII.

PECTEN (*continued*).

FIGS.

1—3. *P.* (*Æquipecten*) *sarumensis*, Woods. *A. quadratus* zone, East Harnham, Salisbury. Dr. Blackmore's Collection. Right valves. 1 *a*, × 4; 1 *b*, antero-ventral portion × 8. 2 *a*, × 4; 2 *b*, anterior part of *a* × 6. 3, × 4. (P. 192.)

4—8. *P.* (*Æquipecten*) *campaniensis*, d'Orb. (P. 192.)

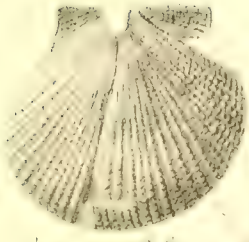
4. Norwich Museum, No. 2044. *B. mucronata* zone, Norwich. Right valve × 2.
5. Dr. Blackmore's Collection. *Uintacrinus* zone, Devizes Road, Salisbury. Right valve × 4.
6, 7. Same Collection. *B. mucronata* zone, Clarendon, near Salisbury. Right valves. 6, × 4. 7, × 4.
8. Same Collection. *A. quadratus* zone, East Harnham. Left valve × 4.

9—11. *P.* (*Æquipecten*) *arlesiensis*, Woods. Chalk Marl, Folkestone. 9, Wiltshire Collection, Woodwardian Museum. Right valve × 4. 10, Museum of Practical Geology, No. 562. Left valve × 3. 11, Same Museum, No. 562. Left valve; mid-ventral part × 6. (P. 194.)

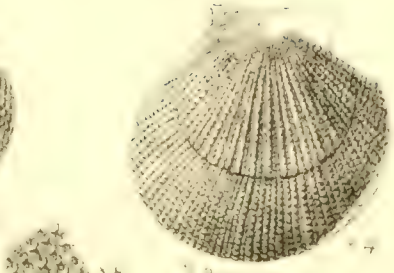
12—15. *P.* (*Æquipecten*) *pulchellus*, Nilss. Upper Chalk, Trimingham. (P. 194.)

12. Museum of Practical Geology, No. 8013 (collected by Mr. C. Reid). *a*, right valve × 3; *b*, ventral part of the same × 6; *c*, part of dorsal third × 6.
13—15. Mr. R. M. Brydone's Collection. Left valves. 13, × 3. 14 *a*, natural size; 14 *b*, part near the antero-ventral margin × 5. 15, × 2.

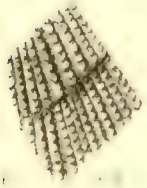
16. *P.* (*Camptonectes*) *curvatus*, Gein. Chloritic Marl, Eastbourne. Woodwardian Museum. Right valve × 3. (P. 159.)



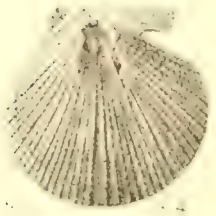
1a ×4



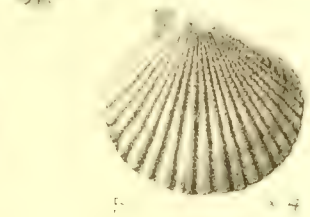
2a ×7



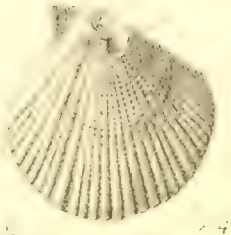
3a ×4



4 ×4

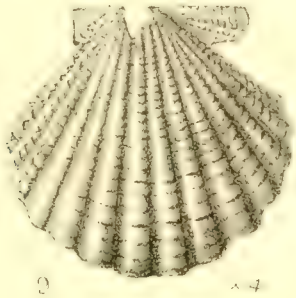


5 ×4

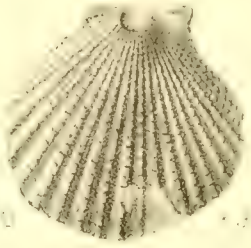


6 ×4

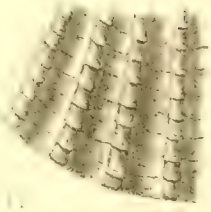
7 ×4



9 ×4



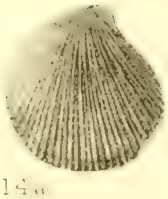
10 ×3



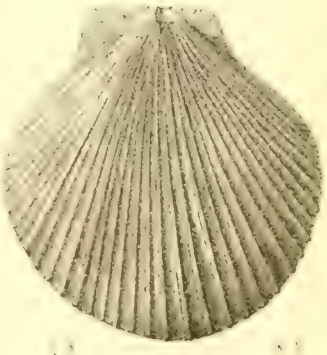
11 ×6

12a ×2

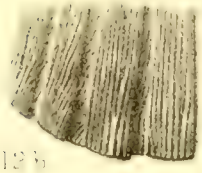
15 ×2



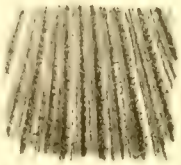
14a



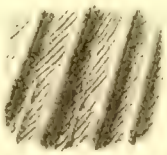
13 ×1



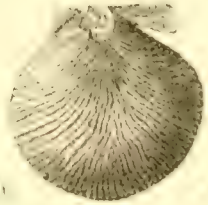
12b ×6



12c ×6



14b ×1



15 ×1

A. T. Hollick del. et lith.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA

PLATE XXXVIII.

PECTEN (*continued*).

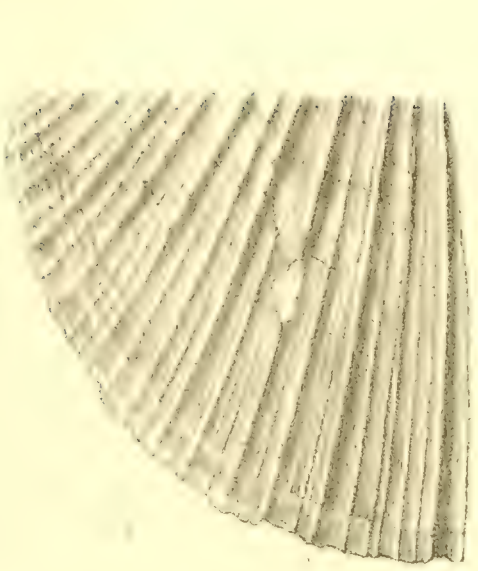
P. (*Æquipecten*) *Beaveri*, Sow. (P. 188.)

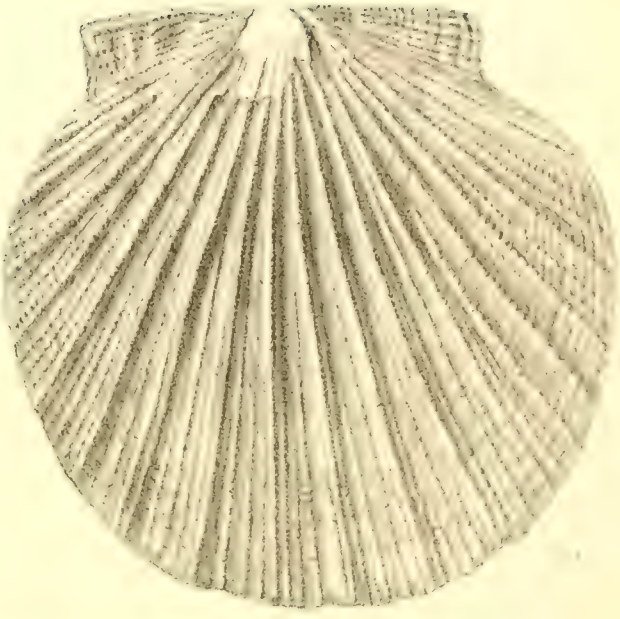
FIGS.

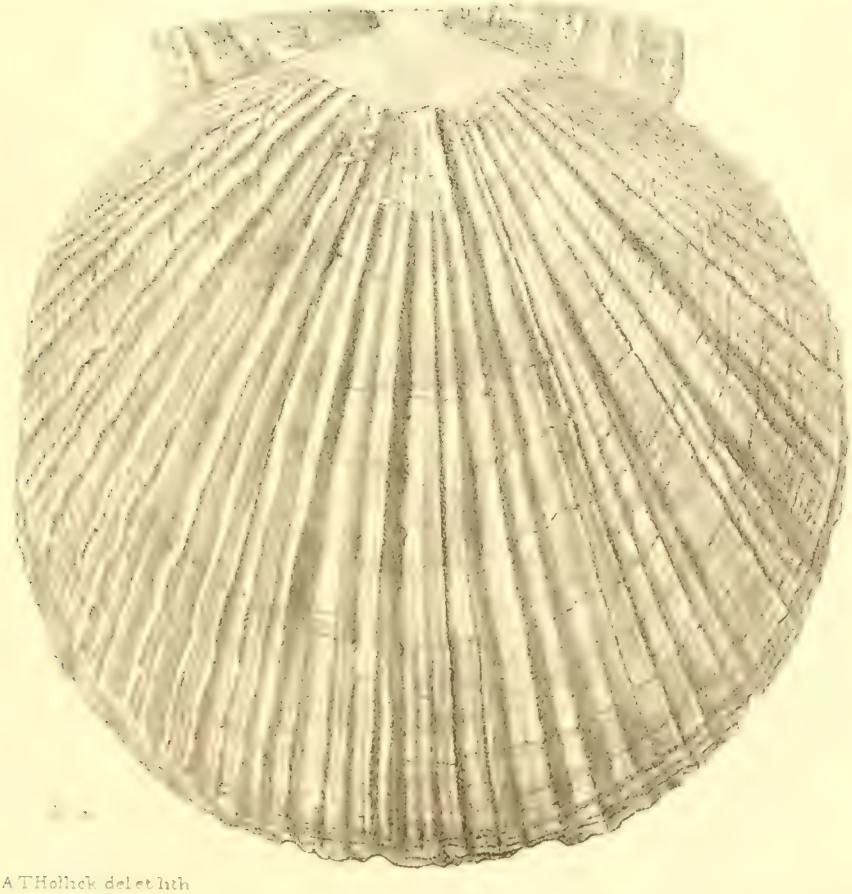
1. Chalk Marl, Dover. York Museum. *a*, left valve; *b*, posterior portion × 3.

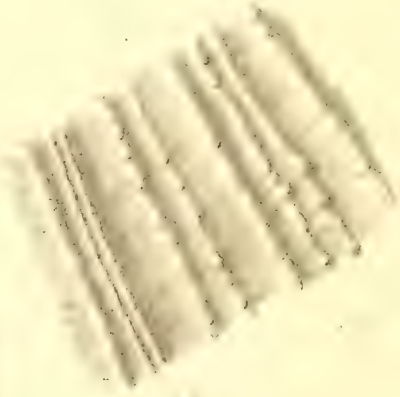
2. *H. subglobosus* zone, Shelford Lime-kiln, Gog-ma-gog Hill. Woodwardian Museum. *a*, right valve (the ears are drawn from another specimen); *b*, antero-ventral portion of left valve of the same specimen.

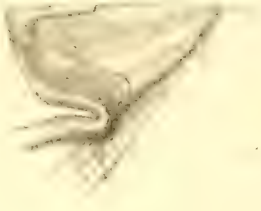
3. *H. subglobosus* zone, Cherry Hinton. Woodwardian Museum. Interior of part of right valve, showing byssal sinus.











A T Hollick del et lith

West, Newman imp

CRETACEOUS LAMELLIBRANCHIA.

PLATE XXXIX.

Pecten (*continued*).

Figs.

1—5. *P.* (*Neithea*) *atavus*, Röm. Lower Greensand, Upware. 1, 5, Mr. J. F. Walker's Collection. 2, 3, 4, Woodwardian Museum. (P. 197.)

1, right valve. 2, left valve. 3 *a*, right valve; 3 *b*, posterior view of both valves. 4 *a*, right valve; 4 *b*, portion between the two middle ribs of left valve × 3; 4 *c*, portion between the two middle ribs of right valve × 3. 5, portion between the two middle ribs of right valve × 4.

6—10. *P.* (*Neithea*) *cometa* (d'Orb.). Upper Greensand, Warminster. (P. 200.)

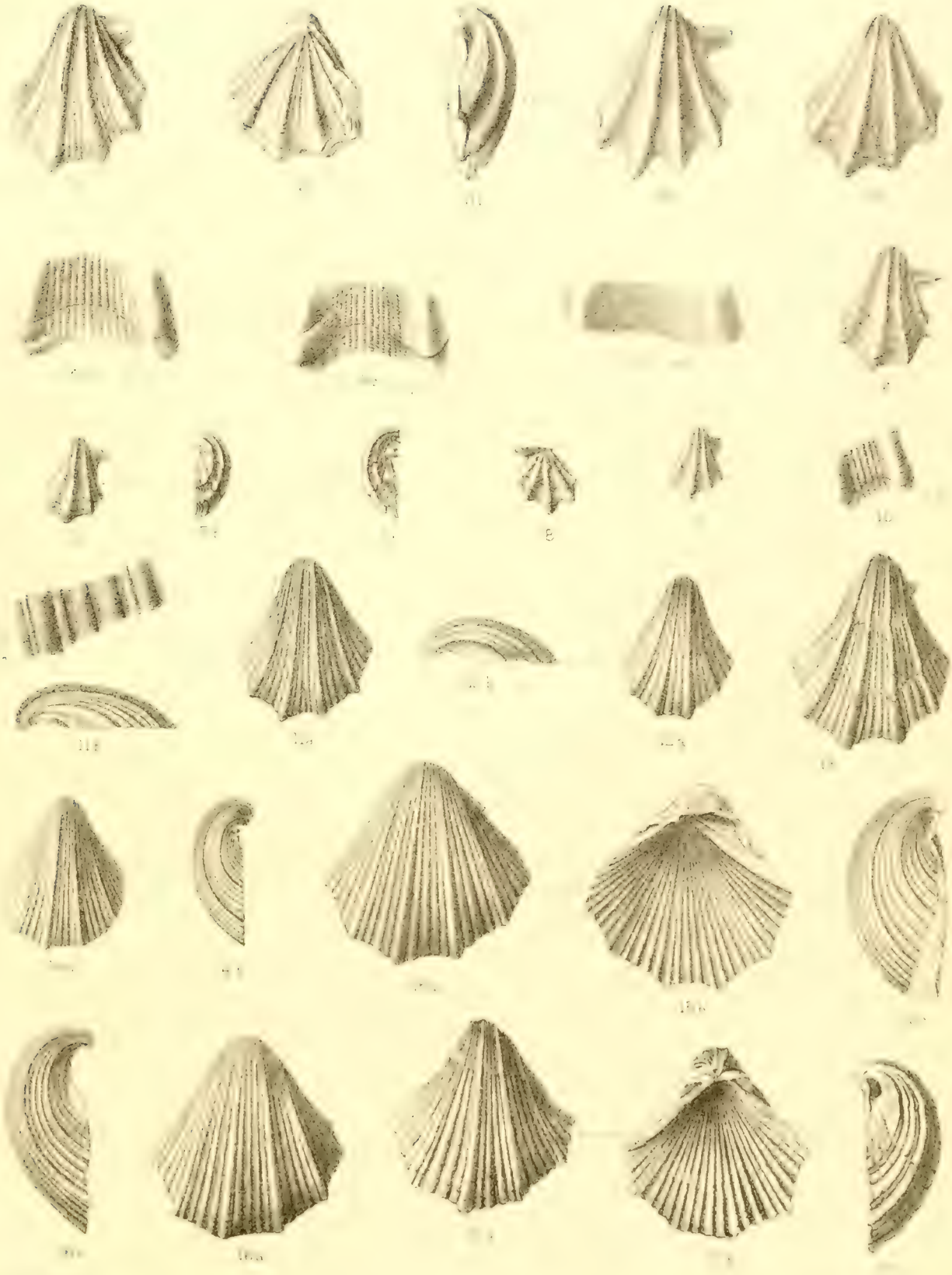
6. British Museum, No. 38267. Right valve.
7. Woodwardian Museum. *a*, right valve; *b*, posterior view of the same; *c*, anterior view of same.
8. British Museum, No. 88871. Left valve.
9. Museum of Practical Geology, No. 8278. Right valve.
10. Same museum, No. 8445. Portion of right valve × 4.

11—13. *P.* (*Neithea*) *Morrisi* (Pict. and Renev.). (P. 201.)

11. Hythe Beds, Lympne. Museum of Practical Geology, No. 8364. *a*, right valve; *b*, posterior view of the same; *c*, portion between two main ribs × 3.
12. Same locality, etc., No. 8446. *a*, left valve; *b*, posterior view of the same.
13. *Perna*-bed, Atherfield. Woodwardian Museum. Left valve—posterior margin restored.

14—17. *P.* (*Neithea*) *quinquecostatus*, Sow. (P. 202.)

14. Upper Greensand, Ventnor. York Museum. *a*, right valve; *b*, anterior view of the same.
15. Upper Greensand (zone of *Pecten asper*), Shaftesbury. Bristol Museum. *a*, right valve; *b*, left valve; *c*, anterior view.
16. Same horizon, Warminster. Museum of Practical Geology, No. 8419. *a*, right valve; *b*, anterior view of the same.
17. Upper Chalk (? *M. cor-anguinum* zone), Gravesend. Museum of Practical Geology, No. 8362. *a*, right valve; *b*, left valve; *c*, posterior view of the same specimen.



F.A.Brocks del.
A.Hollick lith.

CRETACEOUS LAMELLIBRANCHIA

PLATE XL.

Pecten (*continued*).

Figs.

1—5. *P.* (*Neithea*) *quinquecostatus*, Sow. (P. 202.)

1. Cenomanian (Meÿer's Bed 12), Dunscombe. Woodwardian Museum. Portion between two main ribs of right valve × 6.
2. Upper Chalk (*A. quadratus* zone), West Harnham, Salisbury. Dr. Blackmore's Collection. *a*, right valve; *b*, anterior view; *c*, portion of right valve × 4.
3. Upper Chalk, probably Sussex. British Museum, No. 74979. Right valve.
4. Upper Chalk (? *M. cor-anguinum* zone), Gravesend. Bristol Museum. *a*, right valve; *b*, portion of the same between two main ribs × 4.
5. Upper Chalk, Sussex. British Museum (Dixon Collection), No. L. 14742. Right valve.

6, 7. *P.* (*Neithea*) *quadricostatus*, Sow. (P. 210.)

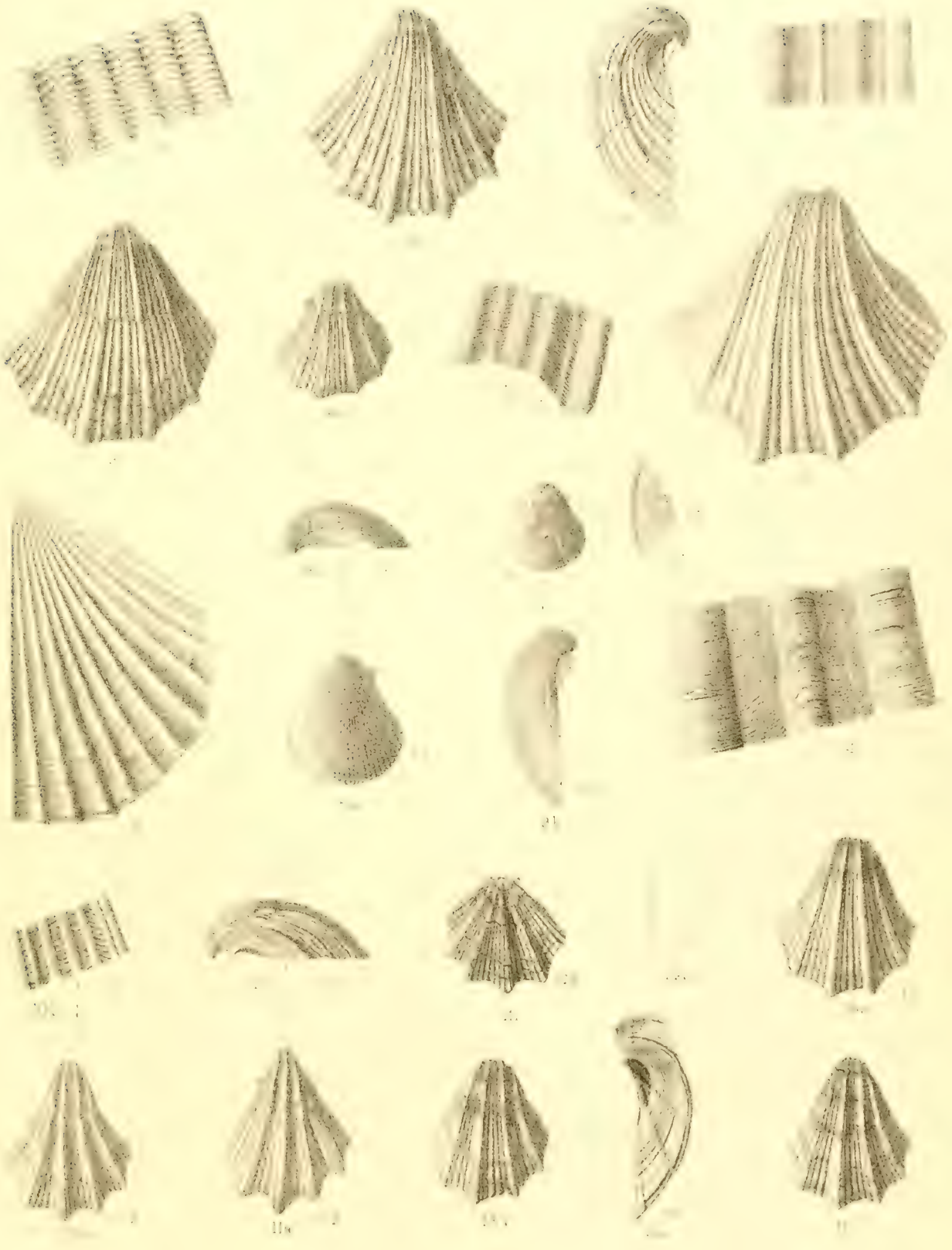
6. Upper Greensand (Chert Beds), Sutton Veny, Warminster. Woodwardian Museum. Posterior half of left valve.
7. Upper Greensand, Warminster. Woodwardian Museum. Portion of right valve × 4. (The line near the middle of each furrow is accidental.)

8, 9. *P.* (*Neithea*) *æquicostatus*, Lam. (P. 208.)

8. Upper Greensand, Worbarrow. Museum of the Geological Society, No. 1530. *a*, right valve × 2; *b*, posterior view of the same × 2.
9. Upper Greensand (Chert Beds, zone of *P. asper*), Haldon. Bristol Museum. *a*, right valve; *b*, anterior view of the same × 2; *c*, part of anterior ear of the same × 4.

10—15. *P.* (*Neithea*) *sexcostatus*, Woodw. Upper Chalk (*A. quadratus* zone), East Harnham, Salisbury. Dr. Blackmore's Collection. Right valves, except fig. 12. (P. 214.)

10 *a*, × 1½; 10 *b*, portion of same × 4; 11 *a*, × 1½; 11 *b*, posterior view of the same × 1½; 12, left valve × 1½; 13 *a*, natural size; 13 *b*, part of posterior view of the same × 2; 14 *a*, × 1½; 14 *b*, outline of the same, posterior aspect, natural size; 15, natural size.



T.A.Brock del
A.T.Hollick lith.

West, Newman imp.

CRETACEOUS LAMELLIBRANCHIA.

PLATE XLI.

PECTEN (*continued*).

FIGS.

1—8. *P.* (*Neithea*) *sexcostatus*, Woodw. 1—5, Form β, Upper Chalk. 6—8, Form *a*, Lower Chalk. (P. 214.)

1. *A. quadratus* zone, East Harnham, Salisbury. Dr. Blackmore's Collection. *a*, right valve; *b*, portion of the two middle main ribs and part between × 4.
2. Same horizon, etc. *a*, right valve; *b*, posterior view of the same.
3. *B. mucronata* zone, Hartford Bridge, Norwich. Woodwardian Museum. *a*, right valve × 1½; *b*, portion of the same near the ventral margin × 4; *c*, portion dorsal to middle of valve × 4.
4. *B. mucronata* zone, Norwich. Norwich Museum. Right valve × 2.
5. *A. quadratus* zone, East Harnham. Dr. Blackmore's Collection. Right valve. Portion of the two middle main ribs and part between × 4.

6—8. Chalk Marl, Dover. Woodwardian Museum. Right valves. 6 *a*, × 1½; 6 *b*, posterior view of the same × 2; 6 *c*, part between two main ribs × 4. 7 *a*, × 1½; 7 *b*, posterior view of the same × 1½; 7 *c*, part between two main ribs × 4. 8 *a*, × 1½; 8 *b*, part between two main ribs × 4.

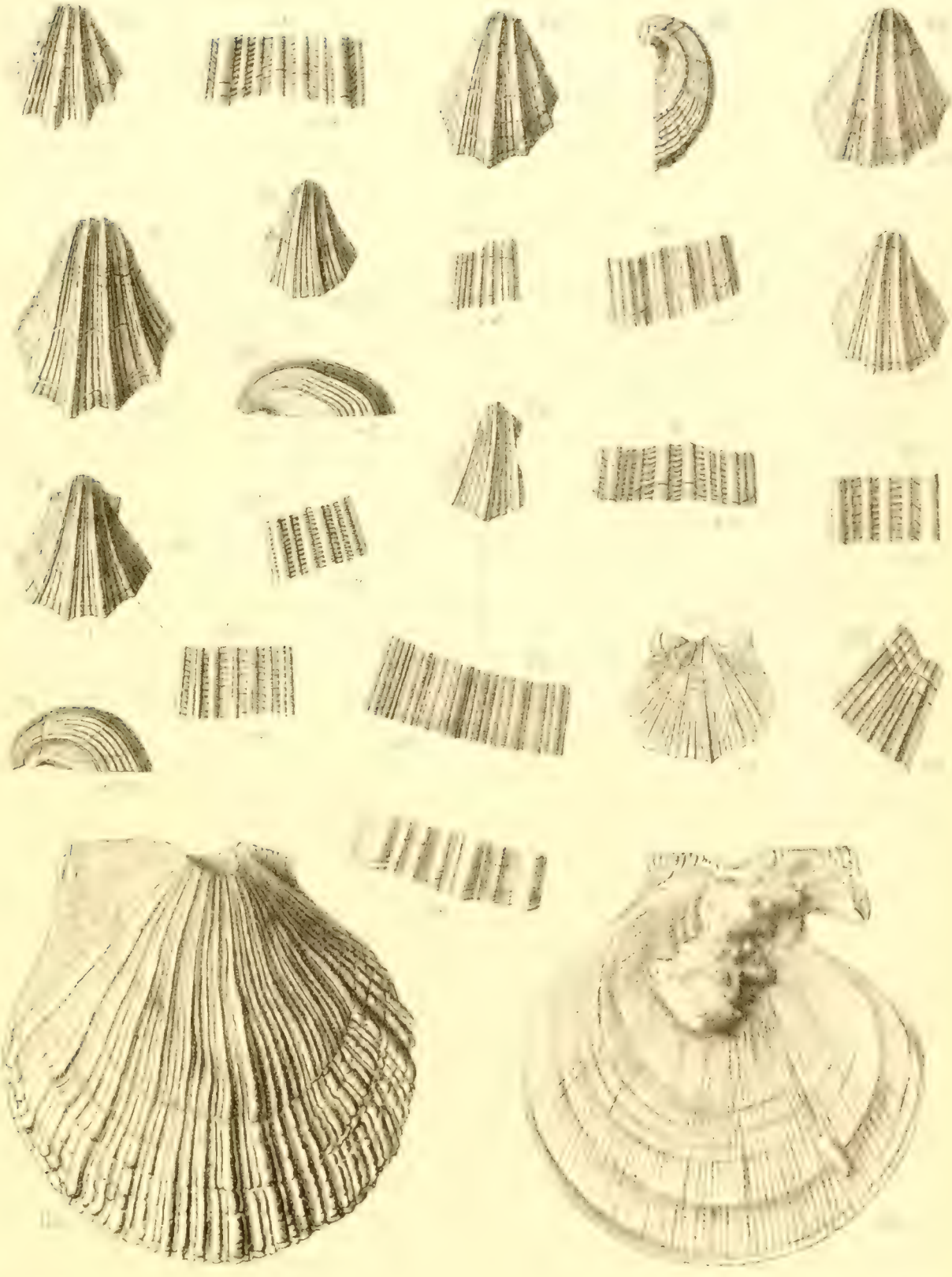
9, 10. *P.* (*Neithea*) *striatocostatus?* Goldf. Chalk, Trimingham. Museum of Practical Geology (Coll. Mr. Clement Reid). (P. 217.)

9 *a*, portion of right valve; 9 *b*, part of the same × 6. 10 *a*, left valve × 2; 10 *b*, part of the same × 5.

Genus—VELOPECTEN, *Philippi*.

11. *V. Studeri* (Pict. and Roux). Upper Greensand, Warminster. York Museum. (P. 218.)

11 *a*, left valve; 11 *b*, part of the same × 2; 11 *c*, right valve of the same specimen.



CRETACEOUS LAMELLIBRANCHIA

PLATE XLII.

Velopecten (*continued*).

Figs.

1—4. *V. Studeri* (Pict. and Roux). (P. 218.)

1. Gault, Folkestone. Wiltshire Collection, Woodwardian Museum. Left valve.
2. Gault (Bed xi), Folkestone. Museum of Practical Geology, No. 1612. Left valve.
3. Cambridge Greensand (derived). Internal cast in phosphate. Woodwardian Museum. Imperfect left valve.
4. Red Limestone, Hunstanton. Woodwardian Museum. *a*, antero-ventral portion of left valve of a large specimen; *b*, portion of the same × 4.

5. *V. trilinearis* (Seel.). Cambridge Greensand (derived). Woodwardian Museum. The type. *a*, left valve; *b*, part of the same near the ventral margin × 3. (P. 219.)

6. *V. pectinatus* (Seel.). Cambridge Greensand. Woodwardian Museum. The type. *a*, part of left valve; *b*, portion of the same × 3. (P. 220.)

7, 8. *V.* sp. Gault, Folkestone. Wiltshire Collection, Woodwardian Museum. 7, left valve. 8, portion of another left valve × 4. (P. 220.)

9, 10. *Pecten Nilssoni*, Goldf. Upper Chalk. Mr. R. M. Brydone's Collection. (Pp. 152, 226.)

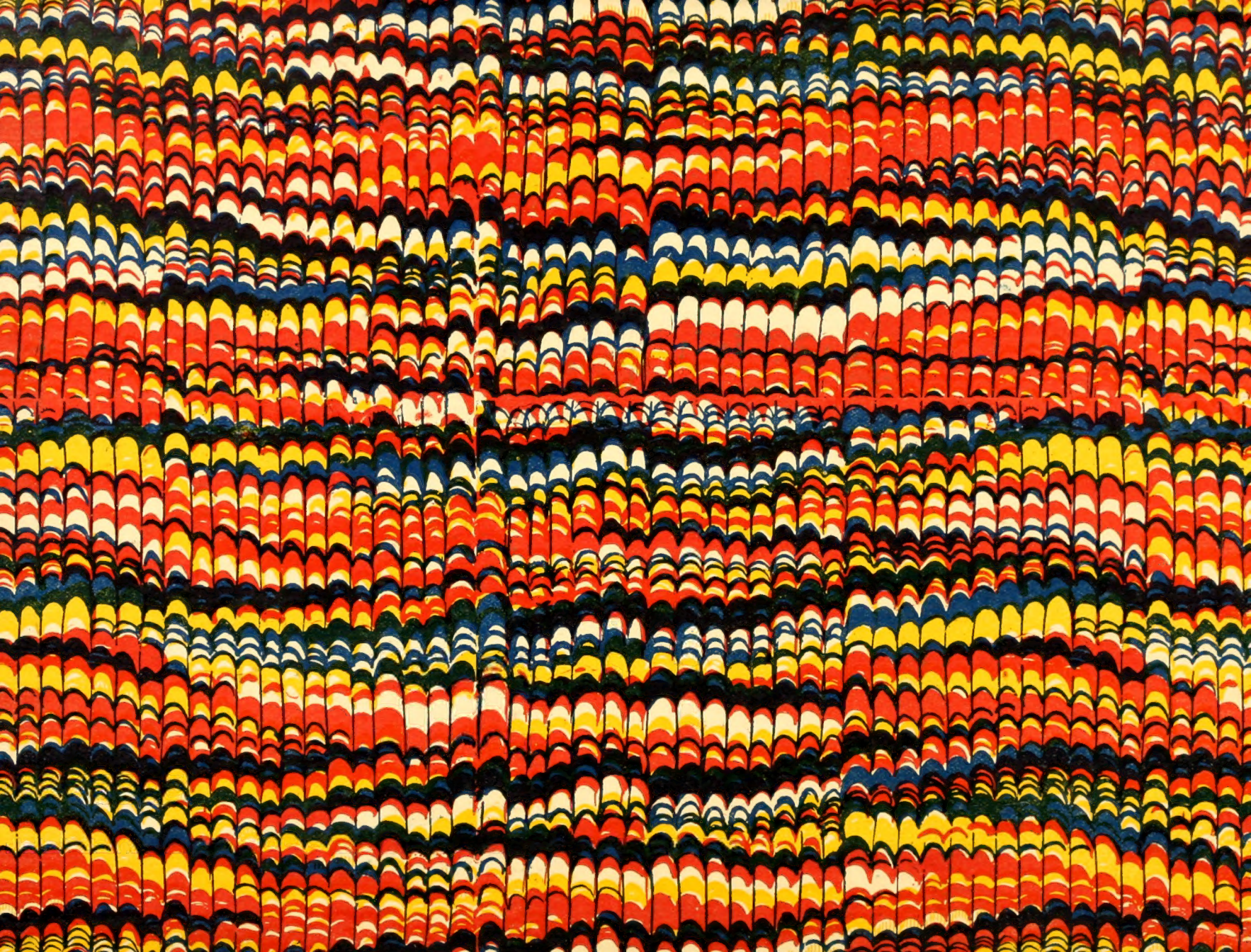
9. Trimingham. Portion of left valve.
10. *A. quadratus* zone, Hampshire. Right valve.

11. *Pectunculus Vaughani*, Woods. Greensand, Blackdown. Woodwardian Museum (Coll. Mr. A. Vaughan). Left valve. (P. 224.)

TABrock del.
ATHelhickith.

West,Newman imp.

CRETACEOUS LAMELLIBRANCHIA.



SMITHSONIAN INSTITUTION LIBRARIES
3 9088 00583 2373